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[OFFICIAL NOTICE.]

Western Gas Association.

SECRETARY'S OFFICE, WESTERN GAS ASSOCIATION, QUINCY, ILLS., May 7, 1890.

The Thirteenth Annual Meeting of the Western Gas Association will be held at the Lindell Hotel, St. Louis, Mo., on the 21st, 22d and 23d days of May. The hall in which the business sessions of the Association will be conducted is within the hotel building, is very commodious, quiet, and in every way excellently well adapted to our requirements. The hotel management has granted on this occasion the following rates: For single room and board, $2.75 per day; for room with bath, $3.25 per day. These rates will apply to members in attendance, their families and visiting brethren. In this connection I am instructed by the Local Committee of Arrangements to give our members warning of the fact that in order to secure suitable accommodations, their rooms *must be engaged in advance.* Your Secretary has been in the habit of making an announcement to this effect with exceeding regularity from year to year, and just as regularly no one, or at least only very few, pays the slightest attention to the warning. The necessity of engaging quarters in advance, however, is in this instance very urgent. Now that the old Planters' House has been closed, the Southern and Lindell Hotels often have more business thrust upon them than they are capable of handling, and of late it has been no unusual occurrence for them to deny would-be guests admission, unless their rooms had been previously spoken for. But all of our members can be accommodated without the slightest jar or friction, if they will but take the trouble to address a line to the "Proprietor of the Lindell Hotel, St. Louis, Mo.," telling him the kind and price of room or rooms desired. This should be done at least one week in advance of the first day of the meeting.

In addition to the reduction in transportation rates granted by the Central Traffic Association, the Trunk Line Association has also joined in the movement. As the boundary of the latter Association extends as far east as the western border of the New England States, our Eastern friends will be enabled to avail themselves of the reduced fares.

I am authorized to state that Mr. R. D. Walsh, Chairman of the Local Committee of Arrangements, has kindly consented to take charge of all articles destined for the Gas Exhibit, and will cheerfully surrender a generous portion of his time to the interests of exhibitors. Communications, consignments of gas stoves, apparatus, burners—anything, in fact, intended for the Exhibit—may be directed to Mr. Walsh, in care of the Laclede Gas Light and Coke Company. Exhibitors can rest assured that not only will their wares receive careful handling and be displayed to the best possible advantage, but that they themselves will be accorded the most courteous treatment at the hands of Mr. Walsh and his efficient committee.

The "Paper List" for our Thirteenth Annual will be as follows:

"Relative Value of Gaseous Fuels," by B. E. Chollar.

"Effects of Natural Gas Competition," by James Somerville.

"An Argument in Favor of the Adoption of a Uniform System of Estimating the Cost of Gas in the Holder," by George G. Ramsdell.

"Impressions of British Gas Works," by George T. Thompson.

"Mixed Gases," by E. G. Cowdery.

"Wrought Iron, Cast Iron, or Steel—which is the Best Material for Street Mains?" by Eugene Printz.

"What Policy Should the Gas Interest Adopt in Connection with the Approaching World's Fair?" by Walton Clark.

"On the Abuse of the Patent System as Bearing on the Gas Industry, with a Remedy," by Frederic Egner.

"The By-Products of Experience," by Allen R. Foote.

The attention of the Board of Directors is called to the fact that Section I., of Article VII., of our By-Laws reads as follows: "The Board of Directors shall meet as such at least once in each year, on the day preceding the annual meeting of the Association, at which time they

shall determine in regard to the propriety of the various papers, drawings, models, or other matters constituting the special order, being laid before the Association." The Board of Directors elected at our last meeting is composed of the following-named gentlemen, who are, therefore, particularly requested to assemble at the Association's headquarters on Tuesday morning, May 20, at 10 o'clock:

J. B. Howard, E. H. Jenkins, Z. T. F. Runner, John Gimper, C. W. Butterworth, E. G. Cowdery, J. S. Ambrose, J. W. Dunbar, and B. E. Chollar.

The social features of the Thirteenth Annual, as provided by the Entertainment Committee, will be as follows:

On Thursday evening there will be a grand moonlight excursion and supper on the Mississippi, the handsome steamer *Oliver Bierne* having been engaged for the occasion. A trip will be made up the river as far as the Chain of Rocks, giving a view of the new water works now in process of construction, and also of the recently completed Merchants' Bridge. On returning, the steamer will run down below Carondelet, affording a beautiful twilight view of the full 16 miles of the city's front along the Mississippi. Supper will be served, and there will also be music and dancing, the boat returning to the wharf at 10 o'clock.

On Friday, at 10:30 A.M., carriages will be in readiness at the hotel for delegates and their guests. A drive will be taken through the western portion of the city as far as the Fair Grounds, where a luncheon will be served at the Jockey Club House. After a series of entertainments, beginning at 2 o'clock P.M., which have been generously tendered by the Board of Directors of the Fair Grounds, parties wishing to take a drive through the parks may do so at their pleasure, in carriages provided by the committee.

Ladies accompanying delegates can obtain carriages at any time dur ing Wednesday and Thursday for such purposes as they may desire.

From the above it will be seen that the time-honored custom of serving a banquet on the second night of our reunion will be departed from. This is an innovation which the committee feels assured will receive a hearty welcome from the "Toast-Responders;" and possibly from many others for the mere sake of a change, if for no other reason.

Application blanks, copies of our By-Laws, and any information not contained in these communications will be cheerfully furnished by

A. W. LITTLETON, Sec'y.

(Since writing the foregoing, your Secretary has received word that the lines operated by the Southern Passenger Association will grant the same rates as those which will be given by the Central Traffic and Trunk Line Associations, viz., one fare and one third for the round trip. These fares can be obtained on the certificate plan. Any railroad ticket agent within the territories of these three passenger associations will take pleasure in informing a member as to the steps that are required for securing these reduced fares. It is hoped that every delegate who can do so will avail himself of the reduction.)

BRIEFLY TOLD.

THE ENTERTAINMENT PROGRAMME FOR THE ST. LOUIS MEETING.—Secretary Littleton's current circular foreshadows with great distinctness the round of pleasure that is to be the portion of the Western's members and guests at the meeting to be held next week in St. Louis, and it will also be noted that the programme this year differs considerably from any that has so far been carried out. The time-honored banquet in formal state on the evening of the second day will not be held this year, and we are inclined to the view that the change, especially when we know that a most charming river trip is to be the enjoyable substitute, will be heartily indorsed by all. But one fear as to complete success can be entertained, and that fear is connected with the nature of the weather on the night of the 22d inst. Given good atmospheric conditions, and the outing on the Mississippi is bound to be a grand success. The balance of the programme for entertainment conjures up great expectations and reflects great credit on the originality and cleverness of those who have the preliminaries in charge. Another very satisfying announcement is found in the determination of the Southern Passenger Association to join in the offering of a reduced rate for passenger transportation. It gives us great satisfaction to be able to add that in every shape and manner the promise of a most successful meeting is assured.

EXIT THE WAKEFIELD MANUFACTURING COMPANY.—Following up our brief note of a week ago in respect to the defeat in the Rhode Island Senate of the scheme proposed by Mr. Addicks for the incorporation of the Wakefield Manufacturing Company, we may say that the matter came up on April 30th in the shape of a report from the committee which had the matter under consideration, to indefinitely postpone the proposed grant. The Senate concurred in this, and a motion for reconsideration of that action was adopted. While this does not completely "kill the bill," in that it may be resuscitated before the next Senate, it may be looked on as extremely improbable that the measure, in its present framing, will ever be again considered. In the meantime the greed of the "Wakefield Company" schemers may actually deprive them of the "free assistance" that they so earnestly invoke in the nature of English capital. Without this latter sinew the paths of certain speculators or traffickers in "good gas situations in America" might have been much harder than they now are, and some of the "good gas situations" might still be in control of those who worked the situations up from poor to good ones. In any event, the leader in the April 22d issue of the London *Journal of Gas Lighting*, which is based on the Wakefield Manufacturing Company's application to the Rhode Island Legislature, sounds an alarm that tends to show that English capital, or rather its controllers, can make the separation between piracy and honest business practice.

MR. TODD'S POLICY.—When Mr. J. R. Todd resigned from the management of the Natick (Mass.) Gas Company to take charge of the gas plant at Middletown, N. Y., every one who knew that gentleman was certain that his success at Natick would be duplicated, at least, in his new field. And so it has been, not only duplicated, but excelled. This pleasant announcement is incited through our receipt of a circular which carries the intimation that the Middletown Gas and Electric Light Company, through Mr. Todd, had arranged for a repetition of the exhibition of gas cooking and heating stoves, similar to the display that was held by the Company in 1888 and 1889. Hearing is impressing, but illustration is the real way of making the picture. The Company hired a suitable apartment in the Dill Building, in Middletown, fitted up a complete exhibit of gas cooking, etc., stoves, and for one week (the display closed last Saturday) showed the beauties and value of cooking by gas to Middletown's housewives. Of course, we do not offer this as anything markedly out of the way, for many such exhibitions have been given in other places; but it takes courage to carry out plans of this kind in a locality like that of Middletown, for the "Managing Director" is apt to veto these on the ground that they cost too much. In any event, Mr. Todd must have all the credit for the results achieved in this direction in his present location, for when he took charge there the Middletown Company had *one* heating stove on its lines, and not a single cooker. Now, however, the lines carry gas to over 100 stoves, with the prospect that before the summer season of 1890 is ended that number will be returned at not less than 150. Again, as an evidence of Mr. Todd's careful guidance, from July 1st to December 31st, 1888, the increase in the Company's gas accounted for was 25 per cent. over the corresponding 6 months in 1887, and a further gain of 15 per cent. is shown in the same respect in the 6 months of 1889 over 1888. Surely this is the kind of management that ought to be appreciated by the proprietors of the property.

NOTES.—The stockholders of the Randolph Gas and Coal Company have assented to an increase in its capital stock of $125,000. The present capitalization is $200,000.——Manager Tracy, of the Poughkeepsie, (N. Y.) Gas Company, is availing himself largely of printer's ink for the popularizing of gas for purposes other than illumination. For instance, we are in possession of a recent issue of the *Evening Enterprise*, in which one and one-half columns are devoted to argument, figures and testimonials respecting the utility and convenience of gas cookers. ——Manager L. C. Grapuer, of the Red Bluff (Cal.) Gas and Electric Light Company, is expending between $4,000 and $5,000 on betterments to the retort house plant. The electric light apparatus will not be added to.

The Market for Gas Securities.

The event of the week in city gas shares was the rise to par of Consolidated, which was bid for at noon to-day (Friday) at 100¼. The figures thus given prove the position taken by us in respect to it. It will go higher, and not a better stock for investment purposes is at present on the market. Other city shares are strong and higher, too. Old Brooklyn gas sold on Wednesday of this week, at auction, at 116. Other Brooklyn shares are also in demand. The feature in out-of-town shares is the continued rise in Chicago gas, which is bid for at 58¾. Laclede common is at 24¾ to 25, and Bay State gas also moved up sharply. We have hitherto been quoting this stock on the basis of $50—the stock is half stock—per share, when it should have been quoted, in accordance with our practice, on the $100 basis. It is bid for at 79. The market in general is strong.

Fields for Scientific Research.

At the annual meeting of the Liverpool Physical Society perhaps the most striking feature of an extraordinarily good meeting was the address of the President, Prof. Lodge, who referred at length to the fields of greatest promise for scientific exploration. An abstract of the address is appended.

Running over some of these open paths we come across a fruitful field in the study of the effects of light on a great number of things. That light affected chemical combinations has long been known, and it is the foundation of photography, but we now find there is scarcely anything which light does not affect. It affects selenium enormously, bringing down its electrical resistance to half or one-third what it is in the dark; it may affect other bodies in a similar way. It affects metals, charging them electrically in a curious way, especially such metals as zinc. It seems to disintegrate or evaporate surfaces long exposed to it. It affects the electric field, causing a short spark to occur much more easily in ultra-violet light than in the dark. And quite recently, by Shelford Bidwell, it has been found to affect the magnetism of an iron rod in a sensitive condition. Of none of these phenomena has the investigation more than begun. Then, in the region of photography, there is a good deal to be done, not only in understanding the photographic process itself, but in photographing rays hitherto intractable. The photography of ultra-red rays a good way below the visible spectrum is, so far as I know, in the hands of Capt. Abney, who discovered how to do it. But others should now take it up and develop it. Celestial photography, with plates sensitive to obscure rays, might reveal a number of unsus pected and invisible semi cool worlds. The electric spark has lately been a favorite subject for photography, and much good work may be done by obtaining judicious photographs of lightning on fixed and on moving plates. A double-nozzled camera, with two plates, one fixed, the other spinning rapidly on an axis perpendicular to its plane (kept spinning at an approximately slow speed, say, clockwork), so that the same flash it depicted on both plates simultaneously, would give much valuable information. For some flashes a very moderate speed of rotation, or even a wiggling camera, suffices, but for others a speed of 30 revolutions a second gives an image apparently the same as if the plate were still. What is known as the Hall effect in various substances has not yet been exhaustively observed or measured. It has not even been observed as yet in insulators, though it ought, one would think, to be there; nor has its connection with the Faraday effect, the rotation of the plane of polarization of light by magnetism, been at all satisfactorily or finally made out; while its discrimination from, or assimilation to, certain known thermo-electric facts is at present hanging in suspense. Perhaps, however, these matters are rather too complex to be suitable for mention under present circumstances.

A simpler and more qualitative research is the effect of magnetism on a number of things. For instance, on living organisms. A person in a magnetic field is not known to feel anything. Reichenbach thought he had found people who were optically sensitive to a magnet, so that they could see whether an electro-magnet is excited or not. It may be so, but subsequent observation has not gone to confirm it. But, even if all persons are insensitive (by no means a likely conclusion without experimental proof), other animals may not be. Phosphorescent things—a glow-worm, or some of the luminous sea beasts of Dr. Herdman—may be fit subjects for experiment. How, again, does a gymnotus or electric eel behave in a powerful magnetic field?

I can imagine a fine field for a physicist to encamp on Puffin Island, under the auspices of the Biological Society, and bully some of the microscopic and other animals with electric and magnetic and optical appliances. Even if they declined to take any notice, the fact ought to be ascertained; but if any of them were properly sensitive, development of the fact might be surprising. Then, again, plants; sensitive and other muscular plants are well known to set up electric currents and to be under electric control; magnetism might be applied to plants also; and about their electric phenomena there is much more to work out. Heaps of experiments on plants and on germinating seeds could be made by an ingenious physical experimenter, and, though they might be more sluggish in their response than animals, some remarkable developments might ensue. A change of physical surround ings in the course of a few generations might bring about noteworthy changes of structure. Seeds growing under inverted circumstances as regards light have, I suppose, already been experimented on. I do not know. I am not familiar with the subject, and the biological suggestions I throw out are therefore vague. But this I feel, that so long as the origin of life is wrapped in mystery, experiments on the simplest form of protoplasm—subjecting it to a variety of kinds of circumstances, electrical, magnetic, optical, thermal, mechanical, and chemical—may any day, though not perhaps for a few centuries yet, result in an astounding discovery, which will throw our present idea of evolution into the shade.

A number of experiments and observations can also be made on crystals and crystal formations by those who have suitable opportunities. The accidental formation of twin crystals, and the beautiful optical phenomena which develop themselves at the twinning surface, are matters of quite recent discovery, or, at least, of recent attention. So also is the perfectly astounding fact that a crystal, such as Iceland spar, for instance, can be mechanically twinned or pushed over into its perverted form by the pressure of a knife judiciously applied. Effects of magnetism on chemical action have now been discovered, and it is known that a piece of magnetized iron is less easily attacked by an acid than ordinary iron, provided, at least, the iron is pointed so that its lines of force are very diverging, or its field rapidly varying. But many other facts remain to be ascertained in connection with these subjects. The electrical properties of flame are only partially worked out, and their power of discharging static electrification has had fresh light thrown on it quite lately by some experiments of Worthington. The study of phosphorescent substances is yet in its infancy. Why should not a phosphorescent substance give out a really useful amount of light? Why is the process by which the glowworm maintains so brilliant a speck of illumination?

Many amateurs possess an induction coil, having, indeed, often made it themselves. Approximately the same number of amateurs do not know what to do with it when made. They use it to illuminate vacuum tubes, which they buy at a shop, nicely colored. Well, don't buy them, but make them, and omit the colors. Read the researches of Mr. Crookes, and other more recent investigations on the subject by Schuster, and Moulton, and Wiedemann and others, and you will find in the electrical phenomena of high vacuum an unlimited field for profitable experiment. More than this: A whole continent of practically unexplored territory has just been opened by the discovery of Hertz that electro-magnetic waves in air can be easily produced and detected. Some may know and some may not know of these brilliant investigations into the propagation of electro-magnectic waves. But any one with an induction coil, an empty room, and some bits of metal can repeat many of them. Any repetition of known experiments is the natural prelude to the discovery of new ones.

The Hertzian receiver is a microscopic spark gap. This serves, but it is by no means necessarily the best, as it is certainly not the most metrical method. Gregory has tried a kind of metallic thermometer with some success. In Germany, I hear, a kind of bolometer or wire resistance thermometer has been successfully used. Quite lately Fitzgerald writes me that a galvanometer in circuit with a simple wire makes these waves apparent. This will simplify their investigation very much. That is always the way. Once a thing has been done, hundreds of ways of doing it turn up. For instance, the telephone. The transmission of speech by electricity seemed a mighty achievement, and so it was; but now, almost anything will transmit speech—a flower pot full of cinders has been made to talk. The great electro-magnetic waves excited by any kind of electric discharge are now under easy control, and they can be reflected by mirrors, refracted by prisms, concentrated by lenses. They can be polarized and analyzed. Diffraction and interference effect can be detected in them. Everything optical has its counterpart in this new region, for they are to all intents and purposes light, as Clerk Maxwell predicted nearly a quarter of a century ago, from refined and abstract mathematical investigation.

The whole of this great field now lies open to the explorer, and only a few have entered it. Here and there a mathematician, here and there an experimentalist, is at work upon it, but there is plenty of room, and every fact is of interest. These electric waves have been obtained as long as 2,000 miles and as short as a foot; they can easily be lengthened, they cannot so easily be shortened. If shortened to the 10,000th of an inch they would affect the retina and be visible. At present they belong to the region of the infra-red. Whether they affect the human frame at all is unknown. Apparently they do not, but further experience may show that they do.

WESTERN capitalists are negotiating with the authorities of Yankton, Dakota, for the right to operate a gas works there. This place is on the left bank of the Missouri river at a point 61 miles west-northwest of Sioux City, and 140 miles north-northwest of Omaha. It is beautifully located on a level plateau, at elevation of 1,200 feet from sea level The river is navigable for steamboats, and it is also reached by the Southern Dakota Railroad. Population, about 9,000.

Leisner's Apparatus for Manufacturing Gas.

On April 29th U. S. Letters Patent (No. 426,823) were granted to George Leisner, of Philadelphia, Pa., for an improved gas making apparatus, the rights for which were subsequently assigned to the United Gas Improvement Company, of the same city. The Leisner specification is as follows:

My invention relates to apparatus for generating water gas, and has for its object to provide a generator of improved construction whereby the gas may be driven off from the coal with which the generator is fed and saved more effectually and with better economical results than has heretofore been the case in apparatus with which I am familiar.

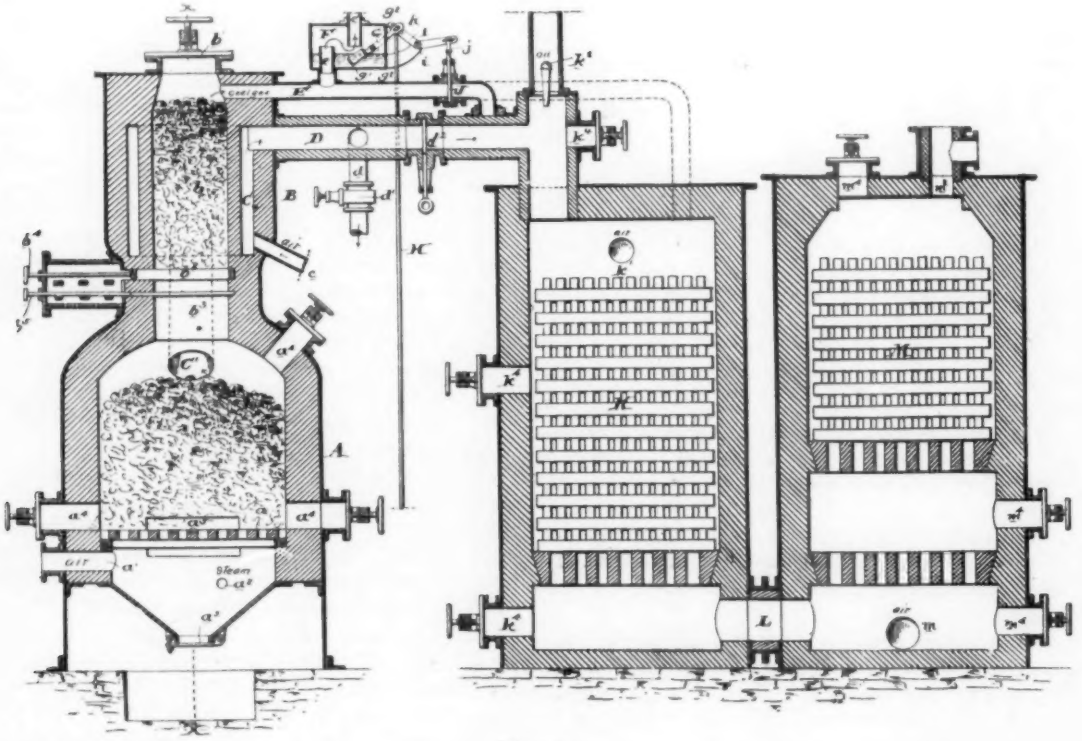
The novel features of my invention will be best understood as described in connection with the drawings in which they are illustrated, and in which Fig. 1 is an elevation in section of a water gas apparatus embodying my improvement; Fig. 2 is a section through the generator and the parts superimposed upon it on the line $x\ x$ of F. 1; and Fig. 3 is an enlarged view of the valve used to close the conduits $e\ e'$.

A is the generator, provided with the usual grate a to support the fuel, an air-blast conduit a', leading into its lower part, a steam conduit a^2, also leading into its lower part, a door a^3 at its bottom to permit the exit of ash from time to time, man-holes a^4 conveniently arranged, and stoking-hole a^5. Upon the top of the generator is supported the structure B, containing a substantially vertical retort b, situated immediately above and in free communication with the generator. This retort is provided at its top with an opening, closed by lid b' or in any convenient way, through which fuel can be introduced from time to time. A chamber C is also formed in the structure B, so as to surround the vertical retort b, and this chamber C is placed in communication with the generator in any convenient way, as by a conduit or pipe C'. A conduit D leads off from chamber C to a system of regenerative superheaters or fixing chambers (indicated in the drawings at K and N), and a conduit E also leads off from the retort chamber b.

All of the above-mentioned parts of the apparatus are substantially shown in various patents, publications, and structures with which I am familiar; but in all such older structures the fuel inserted in the vertical retort is supported by and forms a continuous body with the fuel in the generator, and no provision is made for passing water gas through the vertical retort, or for saving all of the gases driven off from the coal. I am aware, also, that coal has been fed through vertical retorts externally heated, with closed bottom and gas passages leading from them, and that such retorts have been arranged in convenient proximity to generators, so that the coke formed in them could be from time to time withdrawn and fed into the generator; but in such cases, also, no provision was made for passing water gas through the retort, and for all operative purposes the generation of gases in the retort and in the generator were totally independent of each other.

By referring again to the drawings, b^3 is a movable grate arranged, as shown, to extend across the retort b and afford a support for the coal inserted in it, and having a handle b^4, by which it can be withdrawn in part or in whole, so as to let the fuel supported by it fall in part or altogether into the generator A.

b^5 is a valve extending across the retort b beneath the grate b^3, and provided with a handle b^5, by which it can be withdrawn in whole or in part at will. Its function is to close the communication between the generator and the retort. The use of the movable grate and valve enables me to entirely close the retort chamber b with respect to the generator when fuel gas is being generated therein, such gases passing through pipe C' into the chamber C, surrounding the retort, and escaping through the conduit D, while the gases generated from the coal in the retort b escape through the conduit E, and can be saved from and without admixture with fuel gas, while at the same time as soon as the generator begins to manufacture water gas by merely withdrawing the valve b^3 such water gas will pass up into the retort b, mingling with the gases driven off from the coal and passing with such gases through conduit E to such point of storage, use, or further treatment as may be desired. Preferably I provide a valve c' in the passage leading from the generator to the chamber C, so that during the generation of water gas the passage may be closed to compel all the gases to pass through the retort b, or partly closed, so that the greater part of the gas will pass through said retort chamber and a small portion into the chamber C. I prefer also to lead an air-blast pipe c, Fig. 1, into the chamber C, so that the gases passing into it may be ignited and combustion kept up around the retort b. Where it is desired to maintain combustion in the chamber C during the generation of water gas, as well as during the generation of fuel gas, I provide escape pipe d in conduit D, and a valve d^2 to close said conduit, so that the products of combustion can be led off through the passage or escape d. A valve d' should be inserted in the conduit d, so that it can be closed whenever the main conduit D is open.



My invention is intended for use in connection with the ordinary system of regenerative fixing chambers by which water gas, together with other rich carbonaceous gases or vapors, are converted into a fixed gas. When so used, the conduits D and E both lead into the fixing chambers, as shown in the drawings. The conduit E may lead directly into the fixing chambers, as is shown by the dotted continuation of said conduit, or it may lead into the conduit D, as is shown by the full lines. In this combination I provide a conduit $e\ e'$, leading from conduit E, and valves to control this passage and to control the conduit E on the farther side of this passage. As shown in the drawings, the pipe e leads into the bottom of box F, through the top of which the continuation e'

of the conduit, consisting of pipes *e e'*, also leads. A lever *G* is secured to the end of a shaft *g*, which passes through the wall of the box *F*, and has secured to it on the inside of the box an arm g^3, holding a cup *g'*, the said cup arranged directly beneath the open end of the pipe *e'*. The lower part of box *F* is filled with tar or some material of like nature, so that when the lever *G* is thrown up and the cup *g'* down it will fill itself with tar, which, when the lever is pulled down and the cup pulled up, as shown in Fig. 3, will make a seal on the bottom of the pipe *e'*. On the outer end of the lever *G* a slot g^2 is formed, through which and a similar slot in a pivoted lever *I* a pin *h*, attached to a rod *H*, passes. The lever *I* is pivoted at *i*, and attached, as shown in Fig. 1, to a link *j*, extending from a sliding valve *J*, situated in the conduit *E*. The above described arrangement is such that the valve's conduit *e e'* and conduit

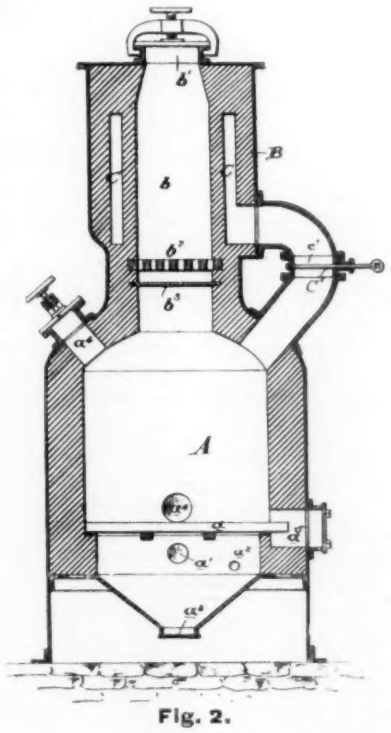


Fig. 2.

E are simultaneously actuated in opposite directions—that is, so as to either open the conduit *e e* and close the conduit *E*, or to open the conduit *E* and close the conduit *e e'*.

The regenerative fixing chambers or superheaters (shown to the right of Fig. 1) are of the common character in water gas apparatus, and need not be particularly described. The gases pass from the generator into the top of the superheater *K*, where they mingle in the combustion chamber at the top thereof with air introduced through the gas passage *k'*, the burned gases passing down through the brickwork and out from the bottom of the chamber through passage *L* into a combustion chamber at the bottom of the superheater *M*, where more air is introduced through the gas pipe *m'*, and the burning gases pass upward through the brickwork and out at the passage m^2, from which connection is made to any convenient stack which will carry off the products

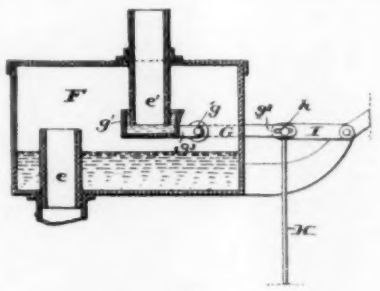


Fig. 3.

of combustion. When the generator is sufficiently ignited and the superheater sufficiently hot, steam is passed into the bottom of the generator and the water gas resulting introduced into the superheaters in the same way as the fuel gas previously introduced. Air, however, is of course shut off from the superheaters, and in general, oil is introduced, as by pipe k^3, to be vaporized and combined into a fixed gas with the water gas by the action of the superheaters, the gases being drawn off finally through m^2 and conveyed to a point of storage or use. The parts marked k^4 and m^3 in the drawings are manholes to permit convenient access to different parts of the superheaters.

My preferred mode of operating the improved apparatus is, after having properly charged the generator with fuel, to thrust the grate b^3 across the lower portion of the retort *b* and close the valve b^3. I then charge a quantity of coal into the retort *b* and close the charging orifice at the top. The air blast is then or previously, if desired, turned on in the generator, and the fuel gases pass through the conduit *C'*, the valve *c'* of which is open, into the chamber *C*, into which chamber, also, air is introduced through the blast pipe *c*, so that combustion shall ensue around the retort *b*. The air introduced at this point, however, need be but small in quantity, as it is not desired to consume any large proportion of the gases in the chamber *C*, which, together with the retort *b*, can be heated to a considerable and essential degree even without combustion in chamber. The gases leave the chamber *C* through the conduit *D*, and are delivered by it into the regenerative chambers *K* and *M*, in which they are completely burned, in order to heat the chambers for subsequent operations. While this is going on the conduit consisting of the pipes *e e'*, leading from pipe *E*, is opened and the pipe *E* closed in advance thereof, as shown in Fig. 1, so that all gases distilled from the coal in the retort *b* pass through the pipes *e e'*, which convey them to a convenient receiver. (Not shown in the drawings.) This operation is continued until the fuel in the generator is thoroughly ignited and the superheating chambers heated to a high degree. The air blast is then shut off from the generator and steam introduced, the valve b^3 opened, the conduit *e e'* closed, and the valve *J* in the conduit *E* opened. The water gas generated in generator *A* can then pass upward through the retort *b*, and out of said retort it passes, together with coal gases driven off from the coal, into conduit *E*, whence it is delivered, either directly or by means of a connection with conduit *D*, into the regenerative fixing chambers or superheaters, through which it passes and is finally delivered to a receiver (not shown), oil, if desired, being injected to enrich the gases. Preferably I also close the valve *c'* when making water gas, so that no gases will pass from the generator into the chamber *C*. If desired, however, the valve *c'* can be adjusted so that a small portion of the water gas will pass from the generator into chamber *C*, and, the air blast through *c* being continued, combustion will ensue, or, rather, be maintained, around the retort *b*. Where this is done it is necessary, in order to prevent admixture of products of combustion with the gases passing into the fixing chamber, to provide a take-off pipe *d* in conduit *D*, and a valve d^2 by which the conduit can be closed on the farther side of the take-off. A valve *d'* is of course provided in the take off pipe *d*, so that it can be closed when the valve d^2 is opened.

If desired, a portion of the water gas may be passed through the conduit *C'*, chamber *C*, and conduit *D*, while another portion is passing through the retort *b*, as already described. All that is necessary is then to cut off the air blast through *c*, so that no combustion will take place in chamber *C*.

The inventor makes the following claims for originality of design:

1. In a gas generating apparatus, a water gas generator *A*, in combination with a substantially vertical retort situated above it and opening freely therein, a feed opening at the top of the retort, a movable grate b^2, arranged in the retort to sustain the coal, a valve b^3, arranged in the retort to control the communication between it and the generator, a conduit leading from the retort, a chamber *C*, communicating with the generator and surrounding the retort, and a conduit leading from the chamber *C*.

2. In a gas generating apparatus, a water gas generator *A*, in combination with a substantially vertical retort situated above it and opening freely therein, a feed-opening at the top of the retort, a movable grate b^2, arranged in the retort to sustain the coal, a valve b^3, arranged in the retort to control the communication between it and the generator, a conduit leading from the retort, a chamber *C*, communicating with the generator and surrounding the retort, an air supply pipe *c*, leading into chamber *C*, and a conduit leading from the chamber *C*.

3. In a gas generating apparatus, a water gas generator *A*, in combination with a substantially vertical retort situated above it and opening freely therein, a feed-opening at the top of the retort, a movable grate b^2, arranged in the retort to sustain the coal, a valve b^3, arranged in the retort to control the communication between it and the generator, a conduit leading from the retort, a chamber *C*, communicating with the generator and surrounding the retort, a valve controlling the communication between chamber *C* and the generator, an air supply pipe *c*, leading into chamber *C*, and a conduit leading from the chamber *C*.

4. In a gas generating apparatus, the combination of a water gas generator *A*, a substantially vertical retort *b*, situated above the generator,

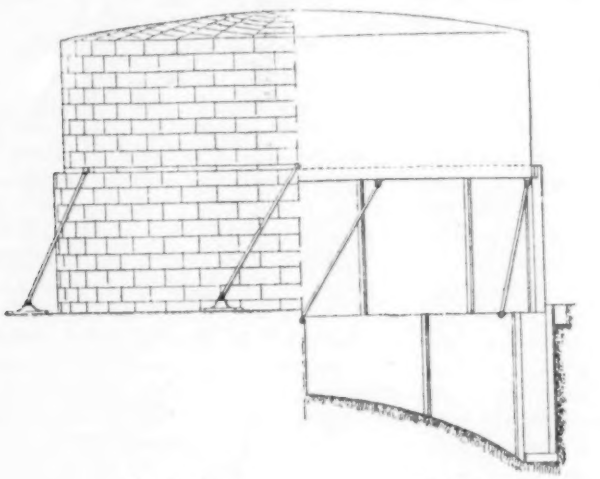
having a feed-opening at its top, and opening into the generator at its bottom, a movable grate b^2 to sustain the fuel in retort b, a valve b^3, to regulate the communication between the generator and retort, a chamber C, surrounding the retort b and connected with generator A, a valve arranged to close and regulate the connection between the chamber C and generator A, a conduit D, leading from chamber C to regenerative fixing chambers, a conduit E, leading from retort b to said fixing chambers, a passage e, leading from conduit E, a valve controlling passage e, a valve controlling conduit E on the further side of passage e, and one or more regenerative fixing chambers connected to conduits D and E.

5. In a gas generating apparatus, the combination of a water gas generator A, a substantially vertical retort b, situated above the generator, having a feed opening at its top, and opening into the generator at its bottom, a movable grate b^2, to sustain the fuel in retort b, a valve b^3, to regulate the communication between the generator and retort, a chamber C, surrounding the retort b and connected with generator A, an air supply pipe c, leading into chamber C, a valve arranged to close and regulate the connection between the chamber C and generator A, a conduit D, leading from chamber C to regenerative fixing chambers, a conduit E, leading from retort b to said fixing chambers, a passage e, leading from conduit E, a valve controlling passage e, a valve controlling conduit E on the further side of passage e, and one or more regenerative fixing chambers connected to conduits D and E.

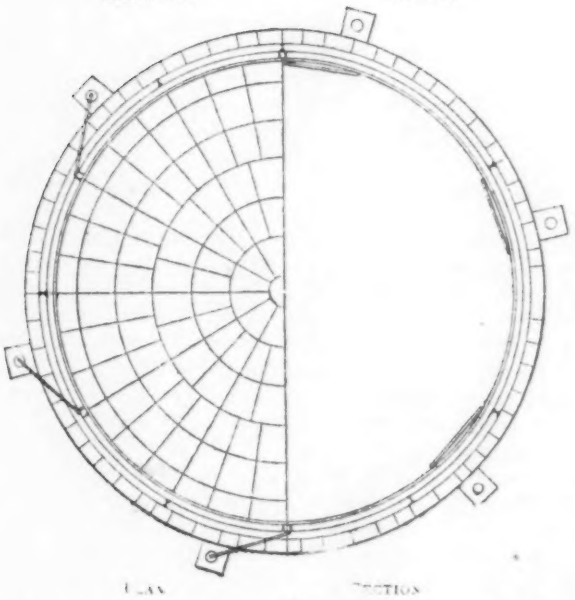
Terrace's Parallel Motion for Gasholder Guiding.

In returning to the subject of gasholder guiding the London *Journal* says:

In the *Journal* for Jan. 8 of last year an illustrated description was given of an arrangement devised by Mr. James B. Terrace, of Brechin, N. B., for guiding gasholders by means of sets of spur wheels keyed



ELEVATION SECTION.



PLAN SECTION

upon spindles long enough to reach the distance at which the guide columns are ordinarily placed round the tank of a gasholder. Mr. Terrace now sends to us for publication a drawing representing a double-lift gasholder, 60 feet diameter (the inner lift 58 feet), each lift being 18 feet deep, the working movement of which is controlled by means of a number of long connecting links situated at regular intervals round the tank, instead of the ordinary guide-framing. A model of the arrangement has, it is said, been made—2 feet in diameter, with each lift 8 inches deep—and is found to work very satisfactorily indeed.

One-half of the drawing is in section, showing the inner lift connecting links *inside* the holder. One end of each link works into a bearing fixed on the botton curb of the inner lift, the other end working into a bearing fixed on the bottom curb of the outer lift of the gasholder. These links, six in number, control the action of the inner lift only; and when the holder is being filled one end of each link rises from the horizontal to an angle of 60°, and remains at this angle as long as the two lifts are cupped. The other part of the drawing is not in section, and shows the outer lift connecting links *outside* the holder. One end of these links works into bearings fixed on the bed plates anchored on the ground outside the stone coping of the tank. The other ends work into bearings fixed on the top curb of the outer lift. These links—also six in number—control the action of the outer lift; and when the holder is being filled one end of the links rises from the horizontal to an angle of 60°, when it is filled to its utmost capacity.

In addition to the ordinary working of the gasholder, the links cause a rotary or side-way motion to take place. All the bearings to which the links are connected, therefore, require to be on the double-joint or ball-joint principle. With this side-way motion of the holder, the bottom curb guide rollers could, however, be dispensed with, as the points of contact deviate in the circuitous path along the upright guides.

The controlling links may be placed otherwise than described above; and in the case of a three-lift holder, two tiers could control the three lifts—one set being used for the inner lift only, and the other set for the second and outer lift. The links for the latter two lifts would be connected to bearings fixed on the top curb of the second lift, the other ends working into bearings fixed on bed plates or columns anchored on the ground outside the stone coping of the tank.

Mr. Terrace claims that, when these controlling links are placed outside the holder, they not only keep it in proper equilibrium during its working movements, but act as strong supports. While some of them are in tension, the others are in compression; and so they relieve the bottom curb of the holder of a large amount of the strain which, in the case of some recent inventions, it is called upon to bear.

Notes on Some Coals in Western Canada.

[Abstracted from a paper read by Mr. Wm. Hamilton, F.G.S., at the Ottawa meeting of the Am. Inst. M. E.]

With the exception of the Vancouver Island coal, all the Western coal fields owe their present development to the completion, in the autum of 1886, of the Canadian Pacific Railroad. While it could not be expected that a very great deal could have been accomplished in three years, enough has been done to pretty thoroughly establish the coal bearing areas and their correspondence with those which have been developed to the south of the boundary along the lines of the transatlantic railroads in the United States.

This summer I visited some of the important developments in the coal areas of Washington Territory, largely with the object of being better able to appreciate the corresponding coal bearing areas in British Columbia to the north.

In Western Canada, coal bearing rocks have been found in three zones.

1. In the plains to the east of the Rocky Mountains and in the eastern flanking ranges, the coal occurs in the Cretaceous formation (including the Laramie).

2. In the interior plateau of British Columbia, the coal is found in the Tertiary formation.

3. On the coast of British Columbia, Cretaceous and Tertiary rocks are found carrying coal, and on the Island of Vancouver the well-known Nanaimo coal has been worked for years in the first-named formation.

In all of these zones the coals vary from lignites up to higher grades, the factor determining quality being the amount of pressure to which they have been subjected. The intensity of this pressure is generally shown by the disturbance which the coals exhibit, and, in many cases, is almost directly in proportion to the distance of the deposits from mountain ranges. This seems to be also the opinion expressed by Mr. Bailey Willis in connection with his census report on the coals of Washington. It has been elsewhere stated that super-imposed strata has been thought to have been an important factor in these changes; but my observations for several years in all these areas lead me to the conclusion that it is

pressure alone from distortion and upheaval that has altered these Western coals into the many varying grades in which they are found to exist.

In the first zone an enormous amount of coal occurs in the territory between the western borders of Manitoba and the Rocky Mountains. I shall merely note some of the seams, which are reached by rail, as examples of the character of the coals in the area mentioned. In the plains they are all lignites, changing to a high grade lignite at the Galt mines (which are reached from the Canadian Pacific Railroad by a branch railroad 110 miles long), into a bituminous coking coal at the Bow River mines (where a 7-foot seam cuts across the main line of the Canadian Pacific Railroad), and finally the maximum result of the metamorphic influence is reached in the Cascade Valley, where the pressure of the mountains, on both sides of the Cretaceous trough, has altered the coal which it contains into an anthracite.

The following analyses, passing from east to west, convey some idea of the types of these coals:

TABLE A.

Eastern Zone.

	a.	*b.*	*c.*	*d.*	*e.*
Water	20.54	10.35	6.50	4.41	0.71
Volatile combustible matter	33.26	34.40	38.04	40.32	10.71
Fixed carbon	41.15	39.61	47.91	48.27	80.93
Ash	5.05	15.64	7.55	7.00	7.57
Total	100.00	100.00	100.00	100.00	100.00
Coke	None.	None.	None.	Good.	None.
Approximate distance from mountains, miles	234	128	36	28	0

a.—Medicine Hat, lignite (Geological Survey), fair coking.
b.—Crawfoot, " " " "
c.—Galt, " " " "
d.—Bow River mines, bituminous, " "
e.—Cascade Valley, anthracite, " "

In the interior plateau of British Columbia lignite and coal have as yet been found in only a few places. The following are the only occurrences yet discovered worthy of notice:

At Princeton or Allison's some 20 feet of alternating lignite and shale seams occur, lying at a gentle dip. The lignite can be obtained of a workable thickness, but the greater part of the bed is too much mixed with shale. The character of the lignite, as indicated by the analysis, is that of an inferior coal.

The lignite found at Marble Canyon, Hat Creek, is of a better description, as shown by the analysis. It is said to be of very considerable thickness. I did not think the quality sufficiently good to justify a visit to the place, which has been described in the Reports of the Geological Survey.

At Kamloops, close to the Canadian Pacific Railroad, coal of a very fair bituminous character has been found; but as yet, seams of only about a foot in thickness have been opened up. The vicinity is being tested by a shaft.

In the Nicola Valley, some 40 miles from the railroad, a seam of bituminous coal, about 5 feet in thickness, has been exposed. This coal has been subjected to a greater amount of metamorphic influence than any yet discovered in this zone. It lies adjacent to a mountain, which is probably a result of the disturbance that has altered it into a good coking bituminous coal.

TABLE B.

Interior Zone.

	a.	b.	c.	d.
Water	15.75	8.60	6.26	36.065
Volatile combustible matter	35.40	35.51	39.97	
Fixed carbon	41.45	46.84	48.22	64.290
Ash	7.40	9.05	5.55	2.645
Total	100.00	100.00	100.00	100.000
Coke	None.	None.	Fair.	Very good.

a.—Allison's lignite.
b.—Hat Creek lignite (Geological Survey).
c.—Kamloops, bituminous.
d.—Nicola, bituminous (Geological Survey).

On the Pacific coast zone, on the main shore, there has as yet been located a very small amount of coal and lignite, in the districts which correspond to the large areas developed along the Puget Sound to the south of the international boundary. And, as has been ascertained to the south of the line, the coal which has been found near the coast is merely a lignite, but that which occurs inland, near the Cascade Range, has been altered into a bituminous coal. A sample of the latter type is found in a 2-foot, somewhat dirty bed of coal, which has been opened on the slope of Sumas Mountain. Still further inland, the cretaceous conglomerates occur near Chillawack, but all the coal which they have so far been found to contain consists of a few small masses forming part of the conglomerate, and some very thin strings of a coaly matter. The analysis from the above-mentioned Sumas Mountain seam is as follows:

Analysis of Sumas Mountain Coal.

Water	4.62
Volatile combustible matter	35.68
Fixed carbon	42.00
Ash	17.70
Total	100.00
Coke	Fair.

On Testing Materials.

Mr. Paul Kreutpointer, of Altoona, Pa., writing in a contemporary, considers that the financial benefits of testing materials manifest themselves in the decrease of supplies required for a given purpose. But it performs also an educational mission of considerable magnitude by forcing the consumer as well as the producers to acquire and exercise thought, skill, knowledge, care and attention. Testing of materials has become a special branch of science and a profession on account of its importance as an economic factor in the industrial world. No engineer can claim thoroughness in his profession who does not possess at least a fair knowledge of the properties of metals and the principles of testing them. Engineers have frequent occasion, in the absence of time or proper appliances, or both, to make what may be called emergency or field tests. Knowledge of the structure of metals and the effects of heat and work on the same are prime requisites to success in testing, handling and working metals. A designer may be a genius in mathematics, yet his work will be deficient in value at times if a text book is the only source of his metallurgical wisdom.

Quality of Metal.—Since materials like iron and steel are apt to vary in quality chemically and physically, testing serves two objects; it must be descriptive as well as comparative. By descriptive testing is meant to obtain, by a simple tensile, bending transverse or other test, a brief description of those qualities of a metal which are supposed to indicate its fitness for a given purpose in everyday service. For instance, the result of a tensile test made on a bar of iron taken at random from a lot of, say, two tons, will give us a sufficient description of the qualities of this particular lot of iron to enable us to consider that iron fit for use in car work. We are not the least concerned in this case how this iron compares in quality with link, stay-bolt or chain iron. As soon as we push our inquiry to the point, how does this metal compare with some similar metal as to quality or usefulness, then testing becomes comparative in intent and purpose? Comparative testing is essentially the basis of calculations of safe stresses and the designing of structures.

What is Quality?—The work of investigating and testing materials would be simple if conclusions could be drawn from one quality as to all the other qualities and properties of a metal. Unfortunately this cannot be done, as our present knowledge of the properties of metals is still too limited in that direction. Hence, we are confined in our investigations to the slow and often expensive work of comparative testing whenever the question as to the better quality of a metal is raised. The qualities and properties of metals are determined by their chemical composition and the manner and extent of mechanical treatment.

The farther a metal has been removed from its original raw state, the more numerous the manipulations it underwent through heating and cooling, hammering and rolling, the more complex has the nature of this metal become. To ascertain the respective qualities and properties thus imparted or acquired, chemical analysis or physical testing is resorted to. The latter may include tensile torsion, bending, transverse, crushing, shearing, drop hammer, nicking or fatigue test, including also etching and microscopic examination. Before making use, however, of any or all of these means to ascertain the quality and properties of a given material, it is well to determine beforehand whether the result obtained shall be merely for the purpose of general information, or whether it is to be applied to any definite purpose, and thus the work done be of relative value. The quality or quantities so obtained are the relative qualities of materials, since those qualities bear a close relation to the work we expect the metal to perform. On the contrary, if the object of testing is merely to gain general information, without its application to useful work, we ascertain the absolute quality of a metal and nothing more. In other words, we learn that a given piece of metal

can carry a load of so many thousand pounds or stretches so many per cent. in a given length before rupture takes place. This then is the absolute quality of a material.

How to Test and What to Test.—Next in importance to the understanding of the import of testing is the knowledge how to test and what to test. To inquire into the tensile strength of metal when we ought to know its torsional resistance or transverse deflection under a given load is obviously erroneous, and if the result is applied to practical purpose, may result in disaster. Or again, an elaborate tensile test is made where a cheap and quick bending test would answer all the purposes of a test. In this or similar cases no harm may result, but testing thus becomes a very expensive luxury. An example of the misapplication of the principle of testing as a guide to quality in the absolute groove or marine test section still prescribed by the Treasury Department as a measure of quality for boiler steel on river steamers. Only thorough knowledge of the properties of metals and of the effects of the form of test section on the result will prevent a misapplication of the economic principle of testing or the retention of antiquated usages and specifications. Wherever testing is carried on as a routine work on a large scale there will necessarily also be done a considerable amount of special and comparative testing. Under such circumstances the question of what to test assumes considerable importance on account of the cost of preparation of test-pieces, help, wear and tear of machinery and possible delays to the service. It would be a mistake to test, therefore, material which may be subject to no strain, perhaps has to carry its own weight only, and might even serve its purpose better if the material did not stand specification, because it would then be too hard. Zeal or desire to appear scientific, want of confidence in the ability or judgment of subordinates or a natural tendency to express everything in mathematical formulas and figures will often be the cause of what might be called "surplus" testing. In all such cases of unnecessary testing the result of the work done is equal to ascertaining the absolute quality of a material—a result which, as explained before, has no practical value.

Value of Testing.—In dealing with so complicated a subject as metallurgy and the products of metallurgical processes, it is essential to success that we look at the question of the value of testing not only in its scientific aspect, but also consider it in the light of purely a business transaction. The aim must be to make money through the medium of testing by saving waste with the least expenditure of money. The employment of cheap and incompetent labor or antiquated, unreliable machinery and appliances, will not do it, however. To try and apply a hard and fast rule, or, in other words, fit the conditions of the service and the qualities of materials to the specifications, is equally erroneous. Like the merchant who watches the quotations of the market, so the one in charge of specifications must watch the changes in methods of producing metals, in a general way at least. Division of labor, for instance, and specialization of product are as powerful factors to success nowadays in a steel mill as in a machine shop. As a natural consequence the product of a mill for a given grade, be that grade high or low, is remarkably uniform during long periods of time. Division of labor makes the furnaceman as much an adept in selecting and handling raw materials as the machinist in turning or planing certain shapes. On that account a manager hesitates to change men from one furnace to another. This fact can be made use of to reduce the cost of testing since it permits the reduction of the number of test pieces. If six test pieces represent the qualities of a heat or a day's work as well as five times that number it is certainly money in one's pocket not to test more than six pieces. There are other reasons besides which strengthen the position here taken. Some of the highest authorities on testing have long since argued that, as the elastic limit of material is its true measure of value in regard to its ability to do useful work, therefore the testing of metals to their ultimate strength and elongation is of no particular value, because no engineer ever expects to see the structures break which he designed. The only merit of the present method of testing up to ultimate strength and elongation is the simplicity of performing such tests.

On the other hand, the argument is advanced, and with good reason, that the amount of "commercial" testing to be done daily in the test department of a large concern, be it a steel mill, railroad, shipyard or bridge works, prevents the introduction of the method of taking the elastic limit as a routine work. A way out of this difficulty might be found in the fact alluded to above, that specialization tends to uniformity of product. Sometimes it also tends to deterioration of quality of product, but with this question we are not now concerned, except to say that in this case also the above fact holds good, for it has been found that material deteriorated in quality is equally uniformly bad. Consequently it would be quite safe to dispense with a large percentage of "commercial" testing in favor of taking the elastic limit as a routine work. The time gained by dispensing with three-fourths of the work now done could thus be ultilized to great advantage. Moreover, if the elastic limit were provided for us in specifications it would often be found that metals from different makers, which test alike as far as ultimate strength and elongation are concerned, would differ in their elastic limit. In other words, one metal would be found less fit to do useful work and therefore be inferior in quality, which inferiority, however, was not revealed with the prevailing method of testing. There can be no doubt of the importance and value of this additional advantage gained by the suggested change in method. Thus it will be seen that routine testing would become at once descriptive and comparative; descriptive as to quality for every day use and comparative as to quality of materials from different makers or different classes of materials.

What has been said will indicate the value and usefulness of systematic and scientific testing and the knowledge of the qualities and properties of metals. Indeed, the diffusion of such knowledge should receive very much attention in colleges, trade and industrial schools and shops. Alexander Holley, whose correctness of views and knowledge on metallurgical subjects no one questioned, used to say that our factor of safety was a factor of ignorance.

Professor Ledebur expresses the same sentiment when he says, in one of his recent works: "The question whether every one who makes use of iron (and steel) for his purposes possesses also the requisite knowledge of its qualities and properties must still be answered in the negative. This may seem paradox in the face of the fact that metals have been so extensively used for a thousand years. The reason, however, is that, first, changes in our industries have taken place during the last 30 years which necessitated the production of certain kinds of metals which were entirely unknown before. Second, because iron (and steel) is now used for many purposes where formerly only wood or stone was used; and, third, because only quite recently science has undertaken a thorough study of the mechanical properties of metals and the raw materials of which they are made."

Of the correctness of these statements there is ample evidence. The time-honored nursery tale of the recrystallization of iron under shocks and vibrations is still rehashed with evident satisfaction as a bit of traditional unscientific knowledge. Some even assert that steel also is possessed of this wonderful property of crystallizing while in a cold and solid state.

The penalty for the want of this indispensable, thorough knowledge of the chemical and physical properties of metals in this age of iron and steel, and the apparent indifference to acquire or diffuse such knowledge, is a heavy tax on our industries and the community at large, in the shape of wanton waste of our resources through excessive wear and tear of materials and their improper treatment. Since metals form the basis of our national industries and prosperity, we cannot afford with impunity to neglect the study of their properties, practically as well as scientifically.

The Construction of Gasholder Tanks.

The London *Journal* asserts that while a marked accession of interest has been imparted to the subject of gasholder design by recent suggested reforms of the established ideas of engineers relating to the conditions of gasholder stability, it is to be noticed that the construction of tanks has not been discussed with a view to any alteration of methed for several years past. True, Mr. V. Wyatt not long ago offered a suggestion with regard to the building of gasholder tank walls in sections instead of in vertically-placed rings, as the common practice is, and claimed some economy for the method; but there is no sign of his plan being adopted anywhere. The exception in favor of Mr. Wyatt's as yet abortive suggestion only goes to prove the force of the remark that for many years—ever since, in fact, concrete was successfully taken into the service for tank building—nothing has been attempted by way of fundamentally improving, cheapening, or expediting the construction of gasholder tanks. The position of the gas engineer now contemplating the addition of another holder to his storage room therefore remains as it has been any time for the last 20 years. The first thing that occupies his thoughts is the tank—where it is to go, and of what it is to be made. In connection with all but the smallest works the tank is the care of one season and the holder of the next; and in some very large establishments the ground must be broken three and even four seasons before the prospective holder will be ready for work. Few engineers are so favorably circumstanced that the questions arising out of the situation and construction of a tank give no trouble. In the majority of instances the need for a tank brings the engineer face to face with an aggravating

array of contrary conditions. He may have settled in his mind for some years the site, dimensions and construction of his next tank, only to discover at the instant of taking the work definitely in hand some insuperable obstacle to the realization of his ideal. He may have reluctantly to confess that he wants an altogether bigger holder than he had vaguely promised himself; or experiences of a disturbing kind may have upset his half-formed plans. If he is a conscientious man, he desires to obtain the largest accommodation for his outlay; and perhaps he has little knowledge of any but local customs in building. Locality largely helps to settle the character of the work; but with all regard to this consideration, it remains true that the skill of the engineer is the most important factor in determining the cost.

Some men who undertake the designing of work of this order have very little notion of comparing cost with result; hence we see examples of tanks of equal capacities constructed for widely different sums in similar situations. One engineer thinks of nothing but making what he calls "a good job," and is utterly oblivious of the blame attached to the designer who wastes material. Another will have brickwork in a stone country, or *vice versa;* and will carry clay for miles, because he is afraid of cement rendering at half the cost of puddle. Another man is so nervous of water that he buys a costly wrought iron tank, merely because the last holder in the same place was so provided; and all the time cheap fuel and powerful pumps would enable him to get down a masonry tank at considerably less expense. There is nothing that tests the knowledge and judgment of a gas engineer like the making of a large tank in a given place. To do the work satisfactorily he needs to know how all the tanks in the neighborhood were built, and what they cost. He must be equally familiar with examples of the cheapest and dearest tanks in the country, in order to decide what of the former he may follow or even improve upon, and what of the latter can be avoided.

"Penny wise and pound foolish" ways must both be known and guarded against. The extravagance of material which is not conducive to strength, because lavished in the wrong place, is as abhorrent to the true engineer as weakness where substance of material is required at any cost. All possible materials and methods of construction must be weighed and compared, and the great question of "to pump, or not to pump," intelligently solved. It is hardly to be wondered at that so many tanks up and down the country fail, or when good, cost very much more than they ought, seeing the number of factors that go to the satisfactory selection of a design, to say nothing of the after troubles that may, and very often do, arise in connection with the nature of the subsoil or the character of the contractor. It seems a hard condition to lay down, that no engineer is justified in breaking ground for a tank unless he is humanly certain that his plan of construction is the best and most economical that could be arrived at in view of all the circumstances, and that in the event of unforeseen difficulties arising with the ground or the contractor he could take hold of the job and finish it for his employers. Yet short of this competence, there is no safety. In tank construction, above all enterprises, it is necessary to be prepared for the worst; so that unless a gas manager feels honestly capable of standing the test here laid down, he had far better confine his cares to the ordinary duties of his office and advise his directors or committee to put the extra work in the hands of a consultant.

The question may well be asked whether the conditions of tank construction, and more particularly for large works of the kind, have been altered of late by the introduction of mechanical improvements in excavating, building, etc. The sinking of foundations for great modern works, such as the Forth Bridge, the Eiffel Tower, and less notorious structures has brought out a number of devices unknown to the last generation of engineers, some of which are undoubtedly available for gasholder tank construction. One reads of and sees appliances for sinking shafts vertically and for cutting tunnels horizontally; and it would be gratifying if the excavation of ground for tanks could be effected by more expeditious and cheaper means than by the navvy and his timberings. Probably something could be done by way of pneumatic or mechanical sinking in the case of metallic tanks of large size; but no suggestion has been offered for reducing the labor of excavating the trench for a brickwork or concrete circular wall. Hoists and steam trollies for removing the soil, mechanical puddlers and concrete mixers, stone breakers, rock drills, and a variety of appliances of a like supplementary character will reduce the cost of digging out and walling a gasholder tank, as of a dock or railway cutting; but there is nothing specially to aid the tank constructor. The indispensable navvy is still the great agent in this class of work.

The capabilities of cement concrete as a material for the construction of gasholder tank walls are gaining acceptance every day, although not by any means so easily as might be supposed by those who have long learnt its value. Puddling a tank to make it water-tight is so immemorial a device, however, that were it a less admirable one than it really is in suitable localities, it would long persist in spite of modern innovations. Far be it from any engineer to speak disrespectfully of puddle where it can be had as cheap as anything else; for a good puddled tank will remain sound until the end of time. Cases have actually been heard of where cement renderings, and even worse—cement sandwiched between inner and outer brick walls—have been used in tanks dug in solid clay that would have been as tight as a bottle almost without any puddling; but only the richest gas companies can afford to support the national manufactures in this lavish fashion. It is exceptional, however, for good clay to be met with throughout the whole depth of a large tank excavation; and where there is any doubt about the puddle, cement is fortunately a ready substitute. A concrete tank can be made out of almost any kind of "hard core;" and as it can be backed up against the solid earth of the cutting—must, indeed, be so built—there is a saving of excavation attendant upon its use.

The necessary thickness of a concrete tank wall is not to be hastily settled; but it is probable that the thickness may be reduced in a remarkable degree if plenty of iron is built into the wall. This latter is a most important—indeed it is the most important—element in the making of a staunch concrete tank wall. Stout bars of flat iron, curved to the radius for which they are required, and with their ends simply hooked together to form complete rings, laid on edge in the thickness of the wall, are the great safeguard for the structure. It may be said to be a point for consideration whether the weight of iron or of concrete shall preponderate in any particular example; but if this way of putting the question is regarded as open to the charge of exaggeration, it is better to incur this reproach than to run the risk of confusion of ideas between the weight of iron bars desirable to reinforce a slight concrete wall and the thin iron hoops commonly used to bond brickwork. Experiments made in the small way in forming concrete tanks for a variety of manufacturing purposes, have demonstrated the advantage of this mixed iron and concrete construction when the iron has been used more liberally and the concrete kept lighter than has ever been attempted for gasholder tanks. The fact that the expansion oe contraction of iron for changes of temperature is practically the same as that of cement concrete removes the fear of fractures from this cause even in regard to structures of the combined material subjected to greater variations of temperature than are met with in gasholder tanks.

The modification of the guide-framing of gasholders, from heavy cast iron columns, concentrating their weight upon even heavier piers forming part of the tank wall, to the lighter standards required for the lattice framing lately in vogue, is a great relief to the tank builder. The idea was held that the piers helped the wall; but this service could only have been performed against the bursting pressure of the water, and not against the crushing force of the earth when the tank was empty, which was the greater danger. As against this problematical assistance, the piers (by unequal settlements) frequently pulled the tank walls out of the perpendicular, giving serious trouble to the gasholder maker. Now that guide columns are spoken of as likely to be dispensed with altogether, tanks should be easier as well as cheaper to make. In concluding this brief review of the conditions of modern gasholder tank construction, it should be remarked that several large examples of this class of work will be commenced during the present season in different parts of the country, full particulars of the most important of which will be given in the *Journal* in due time. From these it will appear whether any new procedure has been introduced into this branch of engineering since the latest designs already published were carried out.

Coal Fields of the State of Washington.

By W. J. Wood, C. E.

The coal fields of the State of Washington, or, I might say more correctly, the coal measures of the Puget Sound basin, consist of alternating beds of sandstones and shales, interstratified with many beds of carbonaceous shales and coal, showing that the period or age is of tertiary formation.

It is found that they lie in a wide trough between the Cascade and Olympic ranges, and east of the Cascade mountains are found also extensive coal basins of older formations. The lignites of this country, however, are found in the central part of the trough lying west of the Cascade mountains and north of Green river, and stratigraphically in the upper series, while south of the above mentioned places and lower down in the measures will be found the true coals, or those resembling them. It is the prevailing theory that the tertiary rocks rest uncon-

ormably on the cretaceous—that is to say, that they were separated from each other by a lapse of time, during which the folding of the older coals and elevation of the mountains took place, and that probably after the development of the latter formations there was a general submergence, depositing the tertiary strata, which follows the cretaceous, and I have found in my examinations hints of the latter formations in various positions. But it is not improbable that in some places there may be a more or less complete strata of passage beds between the cretaceous and tertiary, as we find by comparison on the eastern slope of the Rocky mountains, where I observed hints of it three years ago in Colorado, Wyoming and Montana coal fields. I might add that it is quite possible that there may be two unconformable series of tertiary rocks. However, much of the disturbed strata observed by volcanic flues, recent drifts and a dense forest is not so materially affected or altered by geological changes as one might suppose, while undoubtedly many changes and faults have taken place which, as a matter of course, is a natural consequence in a volcanic and mountainous country. But, on the other hand, we find it adds greater advantage for mining purposes, as also in qualities, to find the measures more or less influenced by geological manœuvers, making them practically available for commercial value and rendering the same easy to mine, while, at the same time, we also find the measures in which the veins are described tilted about suitably in various degrees of angles, from 20° to 85°, as seen in the Wilkinson, Green river and Raging river coal fields, and east of the mountains, so as not to interfere with the working of the coal beds, providing proper mining methods are used. I have seen many mines where a suggestion would result in the mining of the coal in better shape for marketable use. The region over which this deposition occurred has since been the scene of mountain making and upheavals of stupendous volcanic eruptions and enormous erosions. Thus we see that the diversities and changes in coal measures which have occurred in the form of anticlinal axis, etc., are preferable in schemes of the working mines to the ordinary flat-vein coal fields, as natural ventilation can be had. The lifting of coal, also water, can all be done at a small cost, if the field to be operated is studied in advance.

Another feature which is to be added to the Washington coal fields, and one which is important, is the timber resources, which exist in vast quantities and in places very heavy, and are composed of fir, cedar, hemlock, spruce and maple. The same can be used for timbering in mines, where large sticks are required for props, etc. The timber resources in this State invariably accompany the coal measures, the latter being without exception overlaid with good standing timber, while in many other States the contrary is the rule, as in the Montana and Wyoming coal fields, where the timber is very light and sparse.

The definition of the boundaries and extent of the Washington coal fields, although a great many areas have been given, is correspondingly difficult, and in some locations and directions is an impossible task, although a description of the boundaries and approximate area will not be amiss, and will be near enough for exactness. The coal fields or the carboniferous area extend from beyond the British boundary south almost to the Columbia river, and from the Pacific ocean eastward to the foot hills of the Cascade ranges, and east of the Cascade ranges, beginning at the foot hills, 25 miles to a point or line running north and south parallel with the ranges, varying from 800 to 5,000 ft. in altitude above the sea level, but buried, on the one hand, beneath recent gravel beds and overflowed, on the other, by eruptive masses; within the boundaries of the above described lines of 8,000,000 to 10,000,000 acres of mineral lands there are probably from 600 to 700 square miles of coal lands, of which a slight portion only is yet developed. The coal ranges in quality from a semi-anthracite up through the other qualities of coals, such as bituminous blacksmithing, lignites, gas and coking coal, and is in inexhaustible quantities. The best sections are those of the Wilkinson and Green river fields, where large amounts are shipped yearly, as also from the Franklin mines, Roslyn and Cle-Elum coal fields and a great number of other successful operating mines which could be mentioned, some of them turning out from 50,000 to 200,000 tons annually. There are over 20 mines in operation, with the prospect of the opening of three new coal fields this year.

While there are many varieties and qualities of coal, there are also many different analyses, but an analysis of one is approximately that of all. In this case it is a bituminous coal having upward of 59 per cent. of fixed carbon and, in some cases, as high as 66 per cent.; volatile matter, 28 per cent.; ash, less than 5 per cent.; sulphur, none. With the lignite we have excellent grades and qualities, which surpass the lignite seen in many other sections of the country. Where I have observed, the quality and grade of the lignites in these sections is probably due to action of a volcanic nature influencing the character of the coal, thus producing a hard, brilliant coal of moderate heating power. It finds a ready market in all cases where the demand for cleanliness and cheerfulness overrules the economy of the greater heating power of the more highly bituminous coal.

On the semi-anthracite of the Natchez and Cowlitz Pass coal fields extensive measures and croppings of large veins of coal have been discovered, the strike and pitch of which extend for several miles, forming anti and monoclinal axes in basins of unknown area, and showing good analysis of the strongest indication for the best uses and purposes of coke making. This section of the country lies dormant in one of the most secluded and remote parts of the mountains. A railroad has been talked of to open up these fields of coal, as it is deemed desirable to tap these fields, owing to the coking and bituminous qualities thus recommended. The coal in this region is probably the result of volcanic rocks running in contact with the coal measures, as faults and as intrusive dikes. They have modified the character of the coal from its original state by pressure and heat, and the influence of a superficial flow would in both these respects be less than that of molten rock before extrusion. Thus the beds of coal have been altered to semi-anthracite of a brilliant luster and an anthracite fracture, and in some places the change is sufficient to produce a bituminous or coking coal.

Here we have reviewed the several kinds of coal, qualities and probable area. In conclusion, I would add that, while at present the Washington coal is generally used for steam and domestic purposes, the general quality of other coals so far discovered in this State is found to be adapted more particularly for making gas and cooking purposes. In either case the coal is very desirable and valuable.

Preservation of Wood by Chemical Means.

Probably the best preserved wood in the world which has been used by man is that found in ancient Egyptian temples at least 4,000 years old. The wood appears to be tamarisk or chittin-wood, and is found as dowel-pins connecting stone work. In removing the old London Bridge, in 1829, piles driven 800 years before were found in good condition. Most of the wooden parts of the roof of Westminster Hall were in good preservation after an equally long period. But if wood may be thus long preserved by accidents of nature, surely chemistry, whose resources are nearly as wide as those of nature herself, can reproduce the accidental conditions, if they are thoroughly understood. It would be difficult to mention any cheap chemical agent which has not, at some time, been proposed as a wood preservative. No less than 57 patents have been taken out in England on various methods of timber preservation. Of these, however, it is well to remark that many were patents on minor detail of the same processes, and also that most of the methods were impracticable.

A solution of corrosive sublimate was used in France early in the 18th century for impregnating wood for protection against insects and decay. It was tried by the Dutch Government in 1730 for protecting its ships against the teredo worm. Owing to the solubility of the sublimate in water, especially in sea water, the process was a failure for wet situations. Mr. J. H. Kyan obtained a patent in England in 1832 for a method employing a solution of one part corrosive sublimate in 50 parts water, and for a long time kyanising was quite popular. It has met with considerable success for timber to be placed in comparatively dry situations. The disadvantages of corrosive sublimate are its inefficiency on account of solubility in water, and its poisonous effect on workmen handling lumber impregnated with it. It is also very expensive, and therefore not practical in many instances.

Mr. J. J. Lloyd Margary in 1837 introduced and patented in England the substitution of copper sulphate (blue stone) for corrosive sublimate It had the advantage of cheapness, and was regarded as one of the most successful of all metallic salts as an antiseptic for timber. This method is still used in France. The objection of solubility applies here also. Mr. Chas. Payne sought to avoid this by first impregnating the timber with iron sulphate, and then with some salt like calcium chloride or sodium carbonate, which reacting with the iron sulphate would give an insoluble precipitate within the cells of the wood. The process is of historical interest only, as it was an utter failure, probably by reaction taking place before the second solution had penetrated the wood, thus preventing its own entrance any deeper, and the resulting timber being protected only quite near its surface. Dr. Boucherie, in 1837, in France, proposed zinc chloride, which is a powerful antiseptic, but extremely soluble in water. The process is known as burnettising, since it was introduced in England by Sir Wm. Burnett. For dry situations, owing to its cheapness and efficiency, it is more largely used than any of the foregoing methods—principally in Holland, Germany and this country.

The way the metallic salts effect the desired end is by forming a chemical compound with the fermentable constituents of the wood—that is, by coagulating the albumen, etc., or, according to the more recent theory of putrefaction, their preservative powers depend on their being poisonous to the bacteria, thus acting as germicides. As early as 1756 attempts were made both in England and America to impregnate woods with vegetable tars or portions of such tars. Coal tar was probably first proposed by Franz Moll, who took out a patent in 1836. He recommended the use of oils both lighter and heavier than water. This was never carried out, as it was obviously wasteful to inject the lighter oils which would soon evaporate.

Various modifications have been continuously made from time to time—mainly in the composition of the creosote used and in the machinery for impregnation. Of course, every creosoting company has its own particularities as regards details, but in general the timber is placed in iron cylinders, sufficient melted creosote added to cover the timber, a partial vacuum produced by an air pump, the whole kept at a temperature of about 110 to 120° F. for several hours, when the air pump is stopped and the pressure pump put on till a pressure of 6 to 16 atmospheres is made in the cylinders, the heat still continuing, and the process being completed in from 12 to 48 hours, depending on the size of the timber. The advantage of the vacuum at beginning of process lies in that water and all liquids boil at a lower temperature under decreased pressure, and consequently the little moisture in the wood is evaporated at a temperature too low to injure the wood. The timber being thus more thoroughly dried, the tar enters more readily and penetrates deeper.

Another quite common plan is merely boiling the wood in coal tar tanks. This is not so good, since nothing like the 10 or 15 pounds of tar per cubic foot forced into the wood under pressure can be obtained by the open tank process. Still another method—and a poor one, too—is painting the wood with boiling tar. To ensure perfect preservation the proper kind of tar should be disseminated all through the wood. As to what is the proper kind of tar, authorities differ, some favoring the lighter tar oils, since these contain a higher proportion of tar acids—carbolic, cresylic, etc.—which they claim prevent decay by killing the germs of putrescence, or by coagulating the albumen, etc., of the wood. Others say that it cannot be these acids which effect the preservation of the wood, since they are volatile and soluble in water, and therefore do not remain in the wood, but that the wood is preserved by some constituent of the heavier oils. This last view seems to be the correct one, since actual experiment has proven the heavy oils equally as good, if not better, than the lighter oils containing 10 or 12 per cent. of the tar acids. The best authorities now believe the active principle in creosote wood preservation to be acridine—found in the heavier oils only. Now, acridine is a deadly germicide, and it coagulates the albumen. The oily body of the tar prevents the entrance of germs and of moisture into the interior of the wood, and this must play no unimportant part in the success of the creosote method.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Gas was turned on to the mains of the Hamilton, Ohio, municipal gas works on the evening of the third inst.

We can also say that Mr. Jas. R. Smedberg, under whose supervision the Hamilton works remained from their inception, has been appointed Superintendent of the plant.

Articles have been filed with the Secretary of State of New Jersey, incorporating the Knapp-Campbell Gas Company. It is capitalized in $2,000,000. The officers chosen to serve in the first year are: Directors, A. Blumenthal, G. Blumenthal and F. B. Spooner, of this city, H. D. Campbell, of Brooklyn, N. Y., J. L. Berg, of East Orange, N. J., and Reed Campbell and D. H. Knapp, of Norwich, N. Y. President, Albert Blumenthal; Vice-President, David H. Knapp; Treasurer, Gustave Blumenthal; Secretary, James L. Berg. We presume this Company is formed for the purpose of exploiting the Knapp gas making apparatus, a description of which will be found in our issue for December 9, 1889, p. 823.

The proprietors of the Vineland (N. J.) Gas Light Company, which corporation can now be said to be freed from the financial entanglements that so sorely emmeshed it a year or two ago, have completed a most systematic and thorough overhauling of the main system, carried out under the intelligent direction of Mr. A. W. Tarbell, of Waltham, Mass. The betterments also included the placing of a street governor, and general repairs to carbonizing apparatus. To show that Mr. Tarbell's plan of main overhauling answered his expectations and the desires of the Company may best be proved by the following. The final meter tests by sections of mains showed a total leakage (on the 5 miles comprising the system) of 34 feet per hour. This means, on comparing the result with that proved before the work of repair was undertaken, to the Vineland Company an annual saving of 700,800 cubic feet of gas, or a reduction in the leakage account of from 25.33 per cent. in 1889, to about 7 per cent. in 1890, without mentioning anything in the saving sure to result from checking the day pressure almost 50 per cent. Money may be made in the carbonizing house, but it is surely lost in the street department, if the service of the latter is imperfect. Look to your street mains.

Mr. E. T. Rowell, of the Massachusetts Gas Commission, has been elected President of the Railroad National Bank, of Lowell, succeeding Mr. Jacob Rogers, who will spend the summer in Europe.

The East River Gas Company has filed a certificate of incorporation. It is capitalized in $1,000,000, and will manufacture and sell gas in Long Island City and Newtown, Queens county, L. I. The Trustees returned for the first year are: Philip Burkhard, L. I. City, Isaac L. Egbert, Clinton Tabor and Franklin Everhard, of New York, and A. D. Ballard, of Yonkers, N. Y. Quite likely this Company is a corporation that either has taken or will take over the franchises and rights of the present Company doing business in the localities named.

Correspondence from Indianapolis, Ind., dated May 2d, is to the following effect: "The power of electricity as a death-dealing agent was demonstrated at the works of the Brush Electric Light and Power Company, here, at midnight last night, when James Clark, an employee, was instantly killed by a shock. Clark had charge of two dynamos, and also assisted in operating the switchboard. The engine operating one of the city circuits had been running 'hot' all evening, and the night engineer gave Clark orders to change the city circuit to one of the commercial engines. A circuit is changed by shifting the wires on the switchboard. Attached to the end of each wire is a wooden handle through which the insulated wire passes. This handle fits into a brass neck and ring with which the wire is hooked on to the switchboard. In shifting the current Clark unhooked the city wire with his left hand and the commercial with his right. As he did so one of his fingers accidentally came in contact with the metal at the end of the wooden handle on the commercial wire. The current, 4,000 volts, threw him backward a distance of 20 feet. Death was instantaneous."

Quite a rumpus was raised by certain citizens of Memphis, Tenn., in respect to a petition that had been submitted to Council by the Equitable Gas Light Company for the right to cross Horn Lake road in front of its works by means of a railroad track of standard gauge. The Company, however, was enabled to show beyond doubt that less inconvenience and danger would be occasioned to residents of the vicinity under the proposed practice (in the matter of transport of materials) than was the case under the existing methods, whereupon Council acquiesced in the petition.

The Columbus (O.) Gas Light and Fuel Company has, in response to an invitation from the authorities, submitted a bid for the public lighting, and suggests therein the possibility of the city using gas to better advantage than could be the case with electricity. The agents by which this could be accomplished are named as the Gordon lamp and an "open burner" of the ordinary type, to consume 8 cubic feet of gas per hour. The letter to the Board of Public Works, which is signed by General Manager Irvin Butterworth, for the Gas Company, then goes on to say: "If granted a 10-year contract, this Company would agree to furnish as many of the above lamps, of either or both kinds, as your Board should see fit to order (the number, once ordered, not to be decreased during that time), and maintain, clean, light, extinguish and furnish gas to them, all at the rate of $45.75 per year for Gordon lamps, and $21.40 for the 8-foot open burners, if lighted during all dark hours—that is to say, 2,500 hours per year; or at the rate of $57.80 for the Gordon lamps and $26.20 for the open burners, if lighted all night and every night during the year. Herewith submitted is a map of the city, upon which are marked the locations of the various kinds of lamps—electric, Gordon, open burner and gasoline—for the purpose of illustrating the saving which may be effected in the street lighting of the city. It will be observed that the electric lights remain upon all the street car lines, and that the gasoline lamps are necessarily marked upon the outlying portions of the city, and in other places not at present supplied by the

Company's mains. It is likely that if we should be given a 10-years' contract we would be warranted in making liberal extensions to our present system of mains, if your Board should desire that we light a larger area than is now covered by them. Upon the plan illustrated upon the map there would be: 152 electric lights at $80 per year, $12,160; 145 Gordon lamps, at $45.75 per year, $6,633.75; 544 open burners, at $21.40 per year, $11,641.60; and 1,100 oil lamps, at $15.75 per year, $17,325, making the total cost for lighting per year $47,760.35; present cost, $76,000; saving per year $28,239.65. Of course, your Board could modify the above number or arrangement of the lights in any manner that you might find would conduce to a better result, and the total cost would be affected in accordance with the foregoing prices, and could easily be calculated. The price herein named for gasoline lamps we are authorized to quote by Jones & Underhill, of this city. We believe that the above, or some similar arrangement of the lamps, would light the city better than most cities in the country are lighted. The lighting would be more thoroughly distributed, and there would be no dark alleys and corners. We believe it would give the people fully as good satisfaction as the present lighting. You will bear in mind that our proposal contemplates the assumption on our part of the first cost of the lamps, the expense of their maintenance and care, and the cost of lighting and extinguishing, the city being at no expense, except for the lamp posts, of which it already possesses a large number not at present in use. Furthermore, the 'all dark hours' lighting would be a total of 2,500 hours per year, whereas, ordinarily, the lighting under the new light schedule is calculated at 2,100 to 2,200 hours per year. In the case of the open burner gas lamps, as heretofore mentioned, they will be made to consume 8 cubic feet of gas per hour. Such lamps in other cities never consume more than 4 to 6 feet, as you will see by the chart which accompanies this map. In fact, an examination of this chart will show you that our proposed charge for the open burner lights is far the most liberal of any charge made in the cities therein reported, and the gas consumed by the Gordon lamps is not only to be charged for at the same rate per 1,000 feet, but the gas consumed by them gives a great deal more light per foot consumed than the open burners. A comparison of the cost of street lighting in Columbus with what is paid in other cities, shows that our streets are being extravagantly lighted. The cost in Columbus is equivalent to 76 cents per capita per annum, whereas, for example, it is 60.5 cents in Grand Rapids, 59 cents in Mansfield, 48 cents in Detroit, 40 cents in Cincinnati, 35 cents in Indianapolis, and 22 cents in Allegheny. We would guarantee to save the city 25 per cent. of what the streets could be lighted for by electricity." The proposal was referred to a committee.

A MEETING of the shareholders of the Birmingham (Ala.) Gas, Electric Light and Power Company is to be held in that city on the 2d prox., to determine whether or not a mortgage of $300,000 shall be put on the property, and to consider the advisability of "selling its electric light plant and privileges, easement, and franchises appurtenant thereto."

MESSRS. WHITE AND CALL, acting for the proprietors of the Marquette (Mich.) Gas Light Company, have published the following circular: "The price of gas has been reduced from $2 to $1.50 per 1,000 cubic feet, and gas bills will hereafter be rendered at the latter rate. This price, we believe, is lower than in any city in the West or Northwest, where the population and the rate of gas consumption are not greater than in Marquette. We are now making an excellent quality of gas, and with proposed additions and improvements to be presently made to our plant we expect to offer gas to our customers for cooking and heating purposes, and believe many of the housekeepers of the city will be glad to avail themselves of its use, and will be pleased with its cleanliness, convenience, and economy." Gas at $1.50 per 1,000 would be reasonable almost anywhere; hence it is more than reasonable at Marquette.

AT the annual meeting of the Cumberland (Md.) Gas Light Company the following result was reached: Directors, Messrs. E. T. Shriver, John McIlhenny, Robt. Shriver, Harrison Swartzwaelder, and James Gardner; President, E. T. Shriver; Secretary and Treasurer, Webster Bruce; Superintendent, J. F. Seamon.

THE title of the Grand Rapids (Mich.) Gas Light Company has been changed to that of the Grand Rapids Gas Company.

THE ordinance by which the price of gas was fixed at $1.25 per 1,000 to the city and $1.35 to the public of Toledo (with 10 cents per 1,000 off for prompt payment) expires on Oct. 8, 1890, and the Mayor suggests that the "Common Council and the Gas Committee should be prepared, before the 1st of October, with a new ordinance establishing the price of illuminating gas for a period of 3 or 5 years." He urges this early attention because in his opinion the proper determination of that question will require considerable study and investigation. And a lot of gammon, too, Mr. Mayor, on the part of the city.

A SPECIAL from Harrisburg, Pa., dated April 30th, says: "Judge Simonton to-day handed down two opinions in the Commonwealth's cases against the Philadelphia Electric Lighting Company and the Brush Electric Light Company, of Philadelphia. Both of these Companies claim to be manufacturing companies, and, as such, exempt from taxation under the recent act removing the tax from manufacturing companies. The opinions discuss at great length the means by which electricity and electric light are produced, and quote extensively from the testimony of Professor Henry Morton, President of the Stevens Institute of Technology, whose testimony as an electrical expert was taken in these cases. But Judge Simonton adheres to his opinion promulgated in a somewhat similar case about one year ago, that producing electric light is not a species of manufacture. He held that neither electricity nor electric light was a material substance, and that there could be no manufacture unless some material substance was produced. It is expected that these cases will all be argued in the Supreme Court, on appeal, at its meeting here next month."

THE authorities of Revere, Mass., have granted a contract to the North Shore Electric Light Company under which the latter will, for a period of 3 years, maintain 175 incandescent lamps (26-candle power) at a rate not to exceed $16 per annum each, on an all-night table; also, 15 arcs, of 1,200-candle power each, to burn from sundown to 12:30 A.M., at the rate of $72 per annum each.

THE public lighting by gas of New York city, for a year from 1st inst., has thus been allotted by the Gas Commission:

Company.	No. Lamps.	Price per Lamp.
Consolidated	17,150	$17.50
Mutual	280	17.50
Equitable	3,600	12.00
Central	2,675	27.00
Northern	2,200	28.00
Yonkers	557	28.00

WE presume that the enthusiastic supporters of the movement for municipal control of electric lighting stations and gas works will find little food for consolation—it might set them thinking, however—in the fact that the Bay City (Mich.) Common Council has about decided to sell out the municipal electric lighting station now owned and operated by the city.

THE West Arlington Improvement Company will probably construct a gas works at West Arlington, Md. D. MacIneston, of New York, is President of the Improvement Company.

THE new Methodist Church building at Downington, Pa., is to be lighted by gas. There was quite a contest between the local Gas and Electric Light Companies over the contract.

THROUGH the courtesy of Mr. T. R. Parker, of San Jose, Cal., we are informed of the death in that city, on April 27th, of Mr. John Fullagar, formerly Superintendent of the Cincinnati (Ohio) Gas Light and Coke Company. The cause of death was heart failure. In his brief note to us on the sad affair Mr. Parker wrote: "Thus ends the life of an energetic man, a kind father, a firm friend and a congenial gentleman." We hope in due time to give to our readers some account of Mr. Fullagar's life.

IN a suit brought in the United States Circuit Court, Boston, Mass., before Judge Colt, the Electric Gas Lighting Company sued Charles E. Fuller, the action being a bill in equity brought for infringement of letters patent, No. 225,071, granted to Henry F. Packard, and No. 232,304, granted to C. N. Sanford for improvements in electric gas lighting apparatus. The patents relate to that form of electric gas lighting where the burner is operated by hand, and which does away with the use of matches. The Sanford device is substantially like the Packard. The apparatus covering both of the patents is called the Packard-Sanford burner, and it appears to have been the first burner of this class which obtained any large degree of commercial success. The defence mainly relied upon is that there was no invention in what Packard did, in view of the state of the art at the time. Judge Colt says: "The Court finds in none of the prior devices the combinations referred to in the third and fourth claims of the Packard patent, and

recognizing the prior state of the art. I think it called for the exercise of the inventive faculty as distinguished from mere mechanical skill to produce the Packard device. Upon the question of infringement I have no doubt."

WE understand that the Selectmen of Marlboro, Mass., have granted the promoters of the Citizens Cas Light Company a franchise.

GOVERNOR BRACKETT having signed the bill repealing what is known as the carbonic oxide law of Massachusetts, water gas can be made in that State without any restriction whatsoever.

ADVICES from Boston are to the effect that on the morning of the 2d inst. Attorney General Waterman forwarded to the House of Representatives, in reply to its order, an opinion that cities and towns have no right to make and sell gas for private use, nor to make it for their own use. He examined the status of cities and towns separately. As to towns he says: "I can find no law or statute by which towns have been authorized to enter into business of a commercial or private nature, such as requires an investment of capital and the employment or particular application of skilled labor or scientific knowledge therein. And I am of the opinion, for the reasons above stated, that under existing statutes towns have no authority to construct and maintain within their own limits and for their own use systems of lighting by gas or electricity; nor can they in connection with such systems sell gas or electricity for private use in such towns." Regarding cities he also gives his reasons and concludes that "cities as well as towns have no authority to construct and maintain either gas or electric light works."

THE Duluth (Minn.) Gas and Water Company has ordered 500 tons of gas and water mains from the West Superior pipe works.

THE May term Grand Jury of Chicago, has found an indictment against Charles V. Henkel, on a charge of embezzling $2,000 from the Globe Light and Fuel Company of 195 Michigan street, that city.

THE proprietors of the Westfield (Mass.) Gas Light Company have voted to reduce the gross price of gas, to consumers of 20,000 cubic feet per month, to $2.37 per 1,000, and to consumers of less than that quantity to $2.50, prompt payment to entitle the consumer to a rebate of 10 cents per 1,000.

WE were recently in receipt of the following circular, copies of which have been extensively distributed throughout the central West. We cheerfully give to Messrs. Hayes & Co. this free advertisement, in the full knowledge that it will curtail their receipts. The circular reads: "*Do you burn gas? Do you desire to save 25 to 40 per cent. on your monthly bill?*—If so, send 50 cents either in stamps or by postal note to the undersigned, and by return mail receive a simple device which has proved this result can be achieved in any business place, hotel or residence in this country. The device and manner of applying it is very simple. It is neat, safe and clean, saving your ceilings from being disfigured by smoke. Once attached, they last the lifetime of the fixtures. The information imparted to you with this device will enable you to change all the burners you may control at a mere nominal cost and the time it will take to adjust them. The question has been asked, Have the public any rights which the gas companies are bound to respect? We answer, Yes. With our device you will only receive what you pay for, and pay for what you receive, and the company will have no way to doctor the meter to produce other results. The thousands already in use justify the above statement. If you personally have no need of this information, please hand this to some friend who may desire to avail himself of this privilege, and greatly oblige C. H. Hayes & Co., 1615 Hough avenue, Cleveland, O. In writing us, give full post office address, which will lessen the chances of delay and miscarriage." Naturally, wishing to keep up with the best practice of the day in the matter of how to burn gas properly or to the best advantage, we at once applied by letter to Mr. G. A. Hyde, of the Cleveland Gas Light and Coke Company, for information respecting the Hayes device, and received from that gentleman the following response: "Replying to yours of the 3d inst., we had received a similar circular and inquiry from another party recently, and sent a person to purchase the device advertised. It proved to be nothing more nor less than the stuffing of a burner with cotton to accomplish the desired result." Perhaps Hayes & Co. will not be grateful for this advertisement.

MR. E. A. VAN HORNE has handed in his resignation to the proprietors of the Utica Gas Company, in order that he may accept the position of Superintendent of the Syracuse (N. Y.) street railway system.

MR. WM. LAWLOR, Superintendent of the Lincoln (Neb.) gas works, was badly burned about the face and shoulders while making an inspection of some repairs that had been made to a boiler in the generating room of the works. The accident occurred on the morning of April 28th.

AN attachment for $136,063.53 has been sued out in the Circuit Court of Chicago by Robert Fulton Cutting against Nicholas C. Miller, who is plaintiff in the suit to set aside his sale of the Lake Gas Company to the syndicate headed by C. R. Cummings. Mr. Fulton's claim is based on a judgment recovered by him against Miller in the Supreme Court, this city, on March 11.

THE annual meeting of the Wilmington (N. C.) Gas Light Company was held on the morning of April 29th, Mr. D. G. Worth acting as Chairman, Mr. J. C. Chase acting as Secretary. The election for Directors resulted in the following choice: Capt. John F. Devine, Dr. A. J. De Rossett, and Messrs. E. S. Martin, Donald MacRae, Geo. W. Kidder, G. H. Smith and Geo. R. French. The Directors subsequently effected the following permanent organization: President, E. S. Martin; Secretary and Treasurer, R. J. Jones; Superintendent, J. W. Reilly. The Company enjoys a most prosperous business.

THE formal transfer of a majority of the shares in the Troy (N. Y.) Electric Light Company to the Troy Gas Company was made on the afternoon of April 29. It is possible that Joseph A. Powers will be retained as Manager.

THE Waukegan (Ills.) Light, Heat and Power Company has been incorporated, with a capital of $60,000, by Messrs. William Stubbs, De Witt Stearns and W. L. Duston.

ACCORDING to the city's books, Rochester, N. Y., maintains 2,719 public lights of all classes. Of these 846 are ordinary gas lamps, paid for at the rate of $18.25 each per annum; 1,083 are of the arc electric type, and which cost 28½ cents each per night; and 790 are of the incandescent electric type (20-candle power), charged for at 4¼ cents each per night.

THE proprietors of the Chattanooga (Tenn.) Gas Light Company, in order to encourage the use of gas for cooking, heating and power, have agreed to allow, from the first inst., a discount of 40 cents per 1,000 on bills for gas used in stoves and gas engines. This is equivalent to a net rate of $1.30 per 1,000.

THE cases of the Laclede and Carondelet Gas Light Companies against the city of St. Louis to enjoin the latter from enforcing the ordinance reducing the price of gas to 90 cents per 1,000 cubic feet, have been ordered continued in Judge Valliant's court until the 20th inst. The court granted a restraining order against the city. In the meantime City Counsellor Bell has filed three petitions in the Supreme Court asking for a writ of mandamus against the Gas Companies to show cause why they continue to disobey the ordinance.

Correspondence

[The JOURNAL is not responsible for the opinions expressed by correspondents.]

Electric Lighting at St. Louis.

ST. LOUIS, MO., May 4, 1890.

To the Editor AMERICAN GAS LIGHT JOURNAL:

On May first St. Louis was lighted for the first time with electric lights; arc lights being used on the streets and incandescent lamps in the alleys. It is safe to assert that never before was St. Louis so brilliantly lighted as it has been since the advent of electricity. When the city was lighted with gas a moonlight schedule was followed. That is to say, when the moon was shining brightly the gas was not turned on. During the past few evenings we have had a clear sky with a bright moon, with all the electric lights going and all the gas lamps lighted to help them. The moon can't continue much longer to aid the electric light, and must retire from business for a time, of course; but the gas lamps are kept burning by order of the Mayor until the electric lights shall have burned satisfactorily for at least 5 nights. To date they have not done so. The city was to be fully lighted by electricity, January 1st. Then the contractors obtained an extension of time until May first, when they claimed to be ready, after a number of trials with the light, the result of which is thus briefly told. There seems to be, after all, a good deal of uncertainty and not a little humbug connected with the electric light. If gas lighting were as dangerous to human life and property as electric lighting has proved to be the daily newspapers would protest all over the land; but, strange to say, the newspapers have nothing to say now. The electric light is probably a newspaper pet, the same as the gas company and the plumber are its old-time chestnuts for bad jokes and abuse, at times when other matter is "short." MOUND CITY.

THE AMERICAN
GAS LIGHT JOURNAL

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PROPRIETORS.

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Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks.

16 WALL ST., NEW YORK CITY.

MAY 12.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share. ☜

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	100⅛	—
Central	500,000	50	85	95
" Scrip	220,000	—	95	100
Equitable	4,000,000	100	118	122
" Bonds	1,000,000	—	113	115
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	115	120
Mutual	3,500,000	100	110	—
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Standard Gas Co—				
Common Stock	5,000,000	100	—	45
Preferred	5,000,000	100	84	87
Yonkers		50	112	—
Richmond Co., S. I.	346,000	50	—	—
" Bonds	20,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	114	117
Citizens	1,200,000	20	70	72
" S. F. Bonds	320,000	1000	100	103
Fulton Municipal	3,000,000	100	127	130
" Bonds	300,000		100	105
Peoples	1,000,000	10	86	88
" Bonds (5's)	368,000	—	100	—
" " (6's)	94,000	—	100	—
Metropolitan	1,000,000	100	102	—
Nassau	1,000,000	25	120	—
" Ctfs	700,000	1000	100	102
Williamsburgh	1,000,000	50	125	—
" Bonds	1,000,000	—	110	112
Out of Town Gas Companies.				
Boston United Gas Co.—				
1st Series S.F. Trust	7,000,000	1000	93	93½
2d " " "	3,000,000	1000	71	72
Bay State Gas Co.—				
Stock	5,000,000	50	79	80
Income Bonds	2,000,000	1000	—	—
Buffalo Mutual, N. Y.	750,000	100	90	95
" Bonds	200,000	1000	95	100
Citizens, Newark	1,000,000	50	155	160
" " Bonds	45,000	—	—	—
Chicago Gas Trust	25,000,000	100	58¾	—
Chicago Gas Light & Coke Co.—				
G't'd Gold Bonds	7,650,000	1000	97½	98¼
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1000	94⅞	95½
People's Gas and Coke Co., Chicago—				
1st Mortgage	2,100,000	1000	—	100
2d "	2,500,000	1000	96	100
Consumers Gas Light Co., Jersey City	2,000,000	100	20	—
Bonds	600,000	1000	80	—
Cincinnati G. & C. Co.	6,000,000	100	201	203
Consumers Toronto	1,000,000	50	190	200
Central, S. F., Cal.			80	90
Capital, Sacramento, Cal			58	
Consolidated, Balt.	11,000,000	100	49¼	49½
" Bonds	6,400,000		107	107½
Citizens Gas Lt. Co., Rochester, N. Y.	500,000	—	75	90
Bonds	250,000		—	—
Hartford, Conn	750,000	25	102	108
Jersey City	750,000	20	170	175
Laclede Gas Light Co., St. Louis, Mo.—				
Common Stock	7,500,000	100	24¾	25
Preferred "	2,500,000	100	—	—
Bonds	9,034,400	1000	84	85
Louisville, Ky	2,570,000	50	125	130
Little Falls, N. Y.	50,000	100	—	100
" Bonds	25,000	—	100	103
Montreal, Canada	2,000,000	100	200	208
Memphis (Tenn.) Gas	750,000	100	40	—
" Bonds	240,000	100	103	—
New Haven, Conn		25	200	—
Oakland, Cal			35	35½
Peoples, Jersey City		—	60	61
" " Bonds			—	—
Paterson, N. J		25	99	102
Rochester, N. Y		50	99	100
Syracuse, N. Y	500,000	25	—	—
San Francisco Gas Co. San Francisco, Cal.	10,000,000	100	55½	55¾
Washington, D. C	2,000,000	20	200	208
Wilmington, Del.		50	88	90

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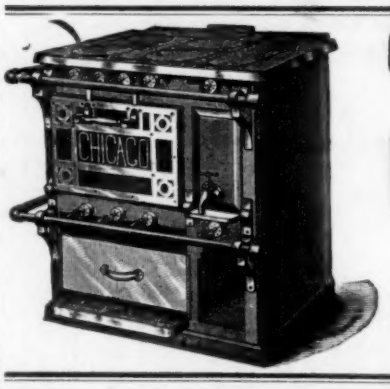

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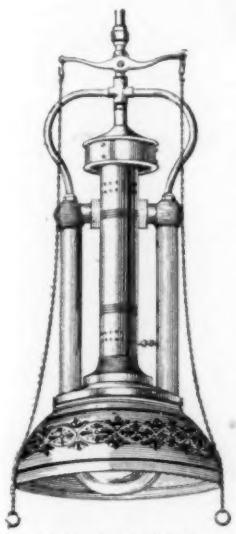

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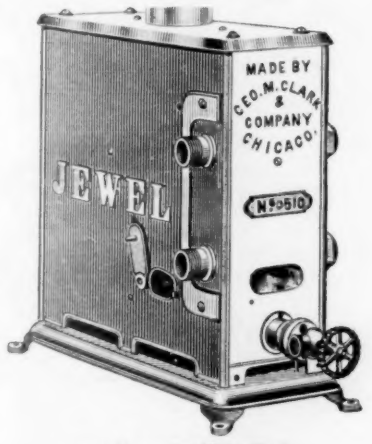

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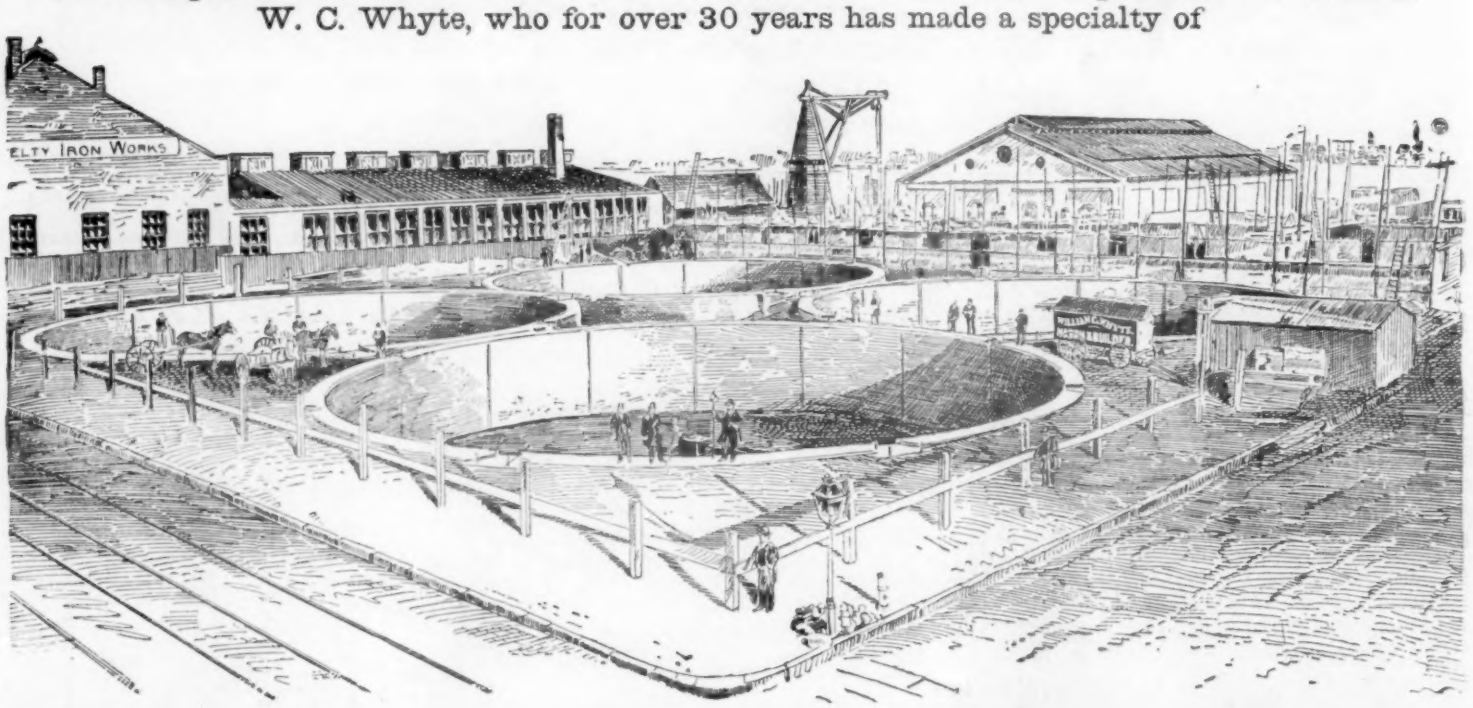

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No. 5,	"	"	750,000	"	"	"	7	"	"	"	
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No. 7,	"	"	1,250,000	"	"	"	9	"	"	"	"
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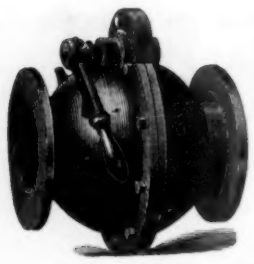

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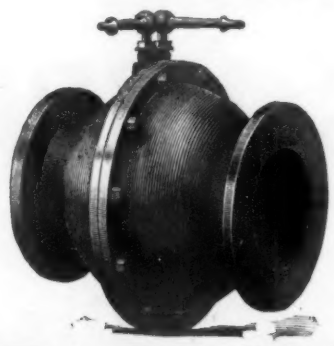

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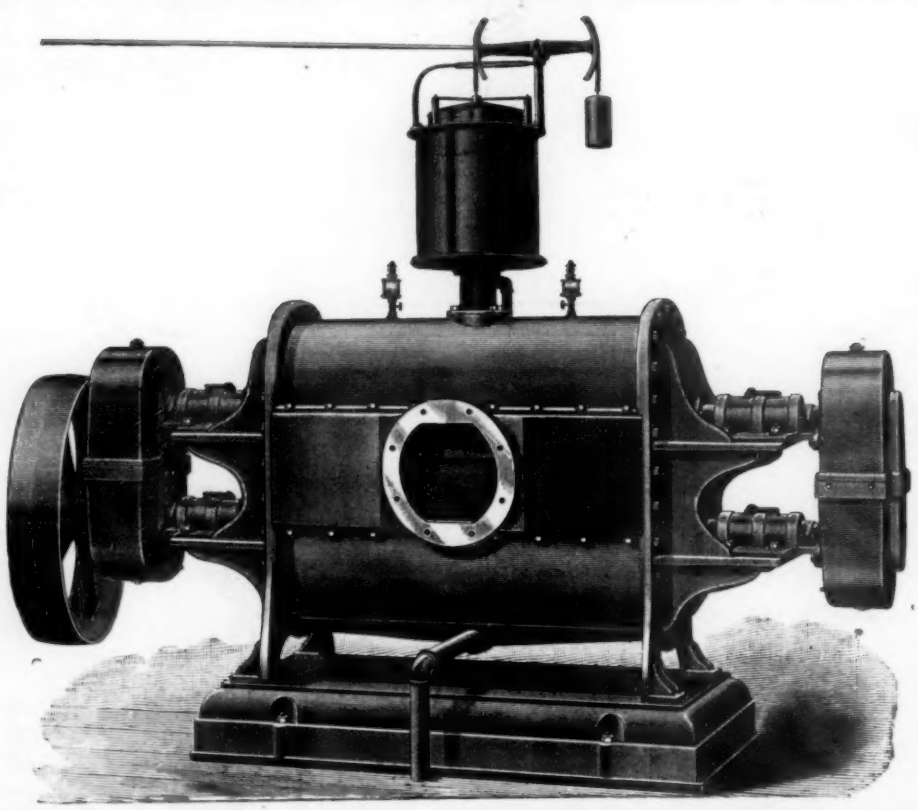

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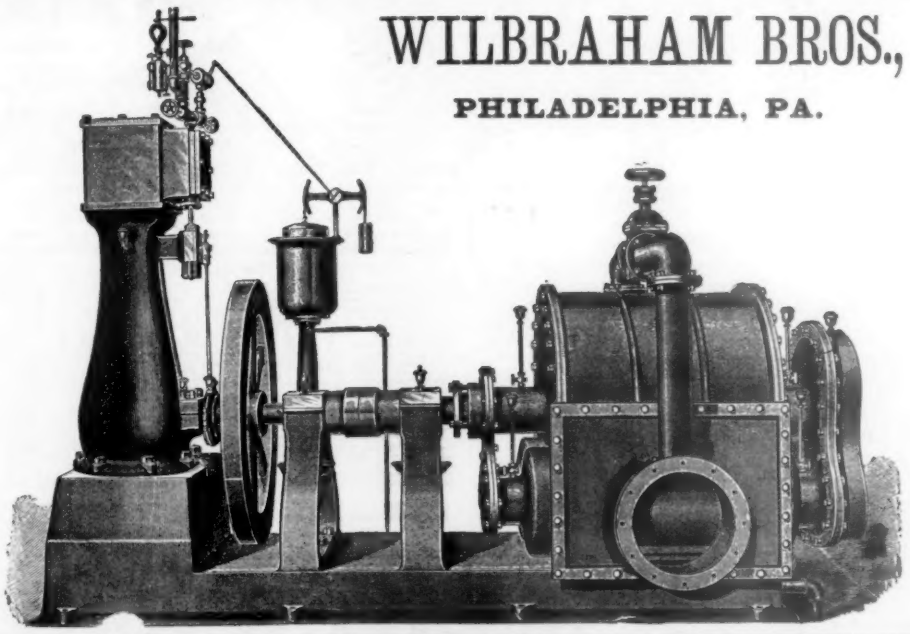

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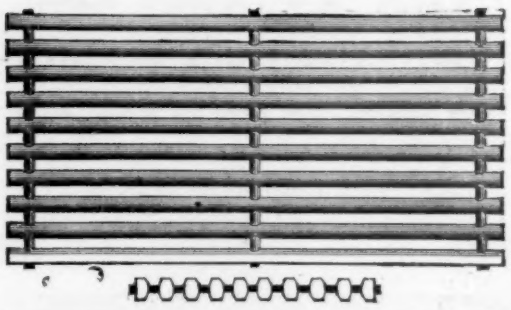

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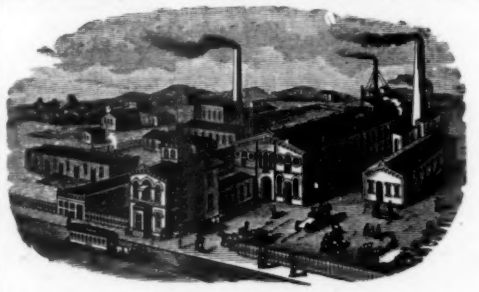

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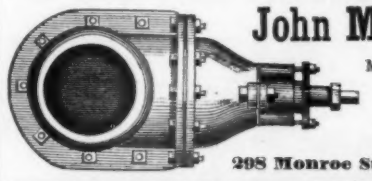

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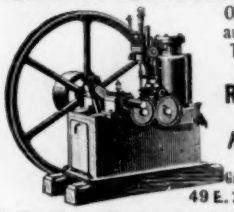

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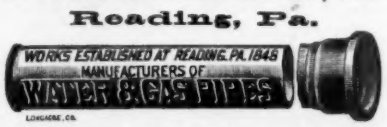

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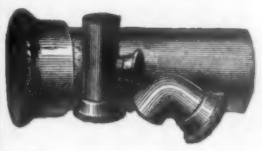

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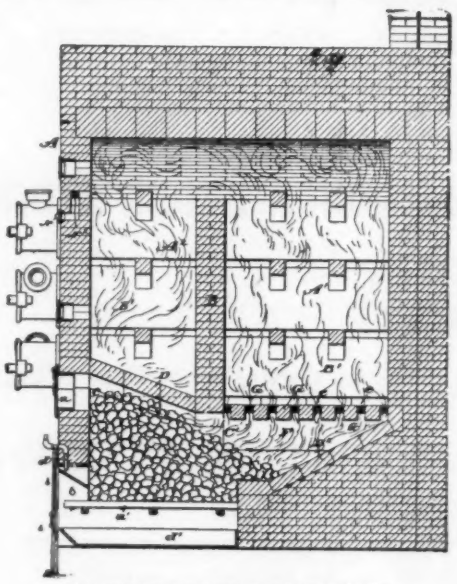

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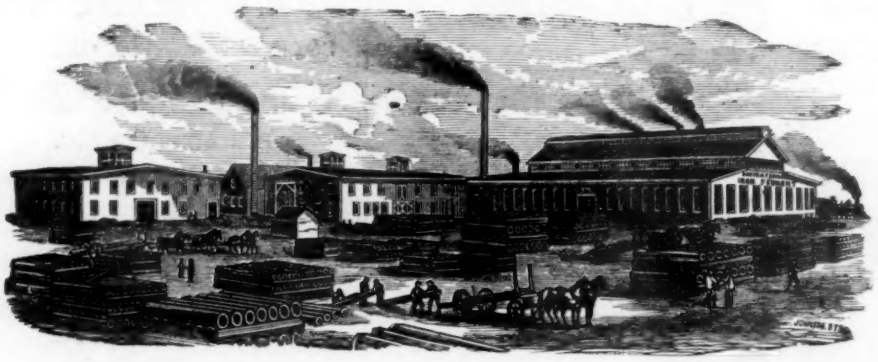

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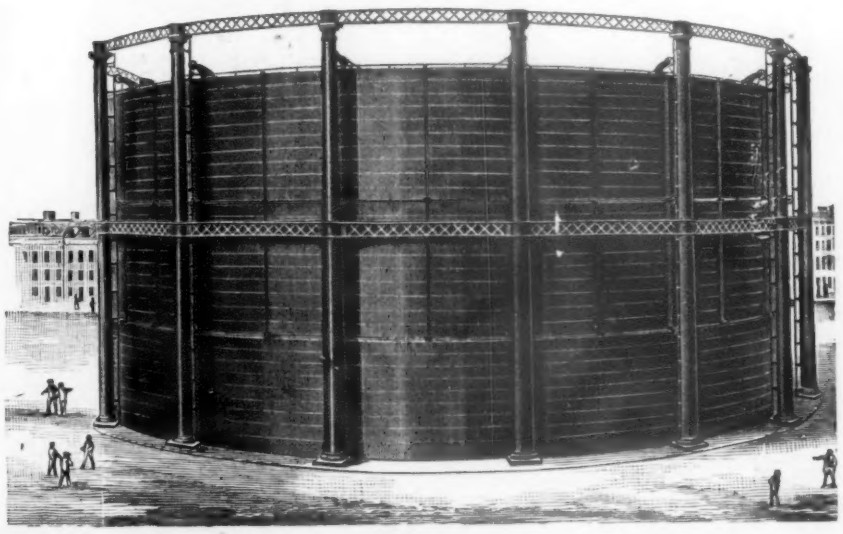

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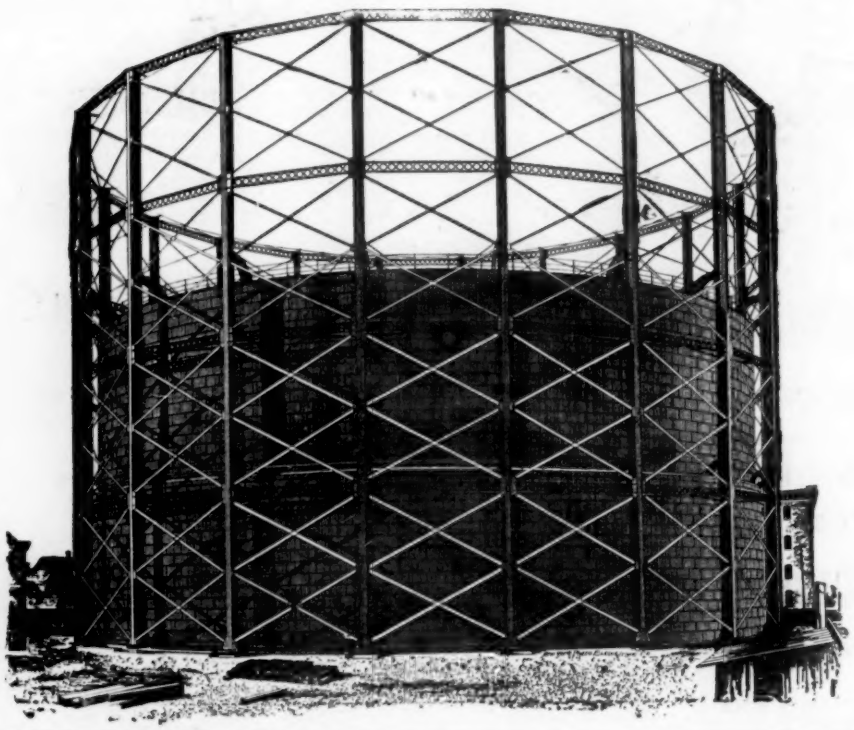

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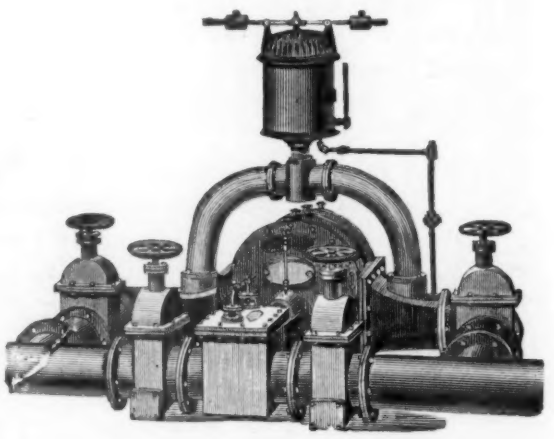

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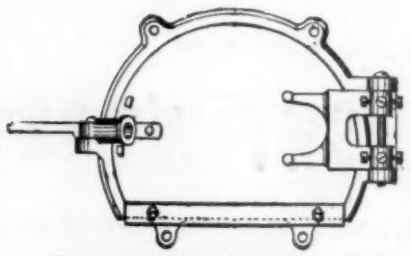

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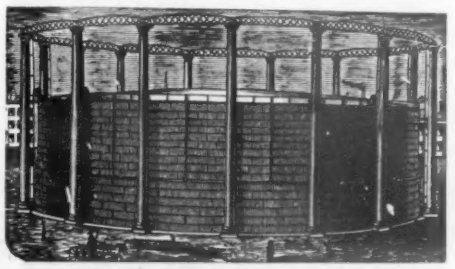

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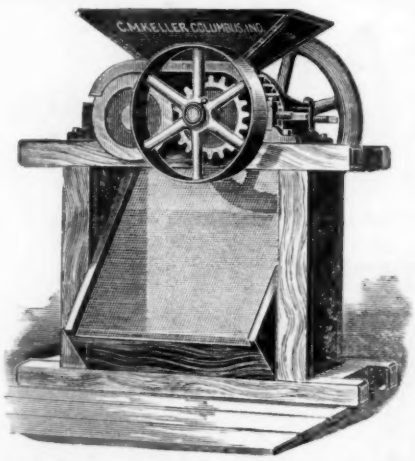

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GAS COOKING STOVE, No. 8 C.

SIZE.

Stove.	Oven.	Roaster.	Top.	Length over Extension Shelves,
37 in. high.	12 in. high.	12 in. high.	24 in. long.	36 in.
29 in. wide.	17½ in. wide.	18 in. wide.	21 in. wide.	
	12 in. deep.	13 in. deep.		

This Stove has four burners on top, and double oven burner.

Consumption of gas with all burners in use, 42 feet per hour, at 1 inch pressure.

The top is made in sections, so that a greater variety of cooking utensils may be used. By lifting out the covers and crosspieces and putting in a suitable forked ring, which is sent with each stove, a wash boiler or other large utensil may be set over two burners. Our **No. 87 GRIDDLE** also fits in the same position. The roasting oven is provided with a cast-iron door.

All Fittings are Nickel-Plated.

GAS COOKING STOVE, No. 7 B.

SIZE.

Stove.	Oven.	Roaster.	Top.	Length over Extension Shelves,
31 in. high.	9½ in. high.	10 in. high.	21 in. long.	32 in.
17 in. wide.	14½ in. wide.	15 in. wide.	16 in. wide.	
	12 in. deep.	13 in. deep.		

This Stove has three boiling burners in the Top or Hot Plate, and one single oven burner.

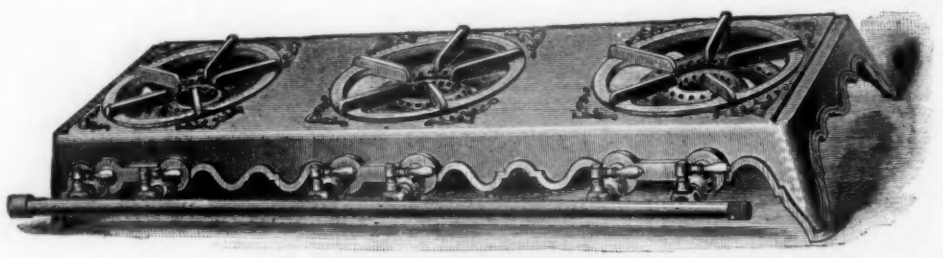
This cut represents our New Style Cooking Stove. As will be seen, it has an ornamented cast-iron Base and Front, and extension shelves. The Oven Burner, which is atmospheric (unless otherwise ordered), is of an entirely new and improved pattern (patent). The ovens are of greater capacity than those of the old style. The Top, in conjunction with the Outlet Pipe, is designed to carry off all the products of combustion, if desired, but they are also supplied with a loose ring which converts it into an ordinary open top stove.

The consumption of this Stove is 35 cubic feet per hour at 1 inch pressure, with all Burners in use.

All Fittings are Nickel-Plated.

"RADIANT" BOILING STOVE, WITH REGENERATIVE BURNER.

Size, 6¼ inches diameter, 3 inches high. Consumption, 6 feet per hour at 1 in. pressure.



HOT PLATE, No. 111.

Size, 36 in. long, 12 in. wide, with three double burners, 6 taps.

Consumption, with all burners in use, 36 cubic feet per hour, with 1 in. pressure.

⅛ in. supply pipe should be used where the pressure is 1 in. or over.